SCIENTIFIC AMERICAN

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NOTES ON FAIENCE AND ITS MANUFACTURE.

No. III.

In our last issue we gave a brief history of faience ware. The present article treats on enameling and baking.

Faience must be baked twice: the body must first receive the necessary hardness, then, after the enamel has been applied to it, it must be baked again to vitrify the coating. These two operations may be carried on either together or separately in the same oven. An oven suitable for accomplishing either purpose alone is represented in Fig. 1. Fig. 5 shows an oven for carrying on both operations together. It is divided into two compartments, the upper one of which, being the hottest, is used for the first operation, while the enameling is done in the lower compartment. There are two fires, A and B, situated on opposite sides of the oven. Fig. 4 illustrates the position of the articles in the oven. They are placed on plates of unenameled faience or "biscuit," supported by pillars of the same material. The success of the operation depends greatly upon an exact regulation of heat. In this respect experience is the only guide. To observe the progress of the operation, cups formed of the same material, enameled and bare, are placed into a special compartment, easy of access, and heated to the same degree as the main portion of the oven. From their condition the progress of the operation may be observed. An oven large enough for about a gross of ordinary pottery consumes about seven cubic yards of wood during one operation, which lasts about 36 hours.

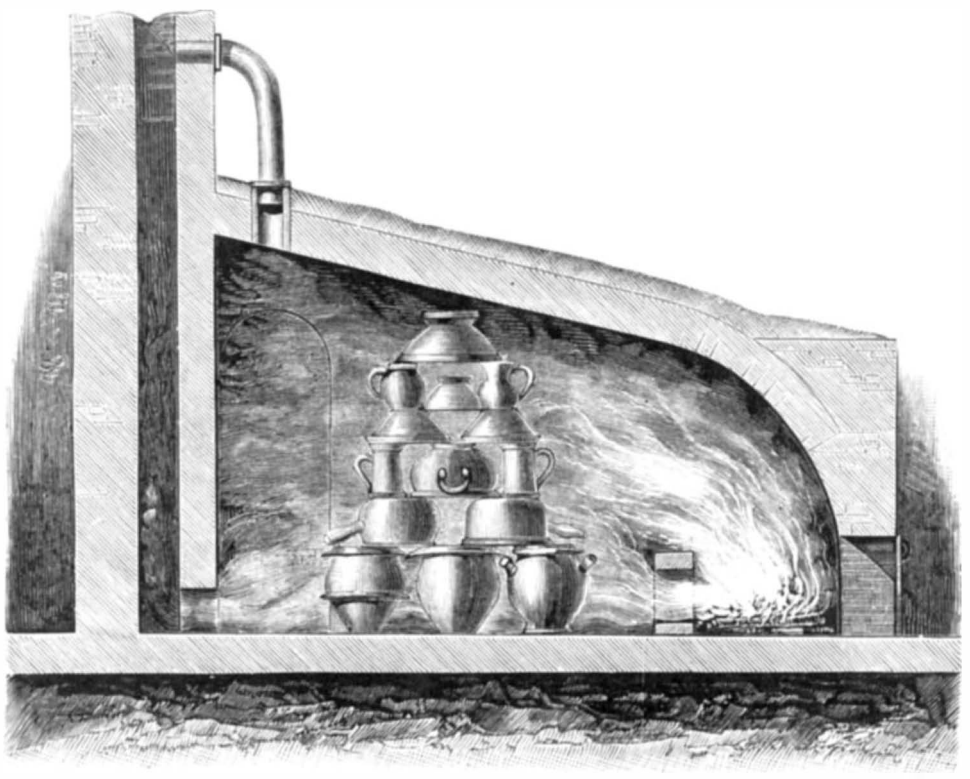

Fig. 1.—POTTER'S OVEN.

The enamel consists of: Minium (oxide of lead), 52 parts; oxide of manganese, 7; brick powder, 41; total, 100.

The substances are fused together and reduced to powder; the enamel is then ready for application. This enamel is intended for brown pottery. For white faience a mixture is used consisting of oxide of tin, oxide of lead, silex, sea salt, and carbonate of soda.

The oxides of lead and tin are intimately mixed and calcined; a yellow powder is thus obtained, called "calcine," and forming the base of white enamel. It is mixed with the other ingredients in the following proportions: Calcine, 47; sand, 47; sodium carbonate, 3; sea salt, 3; total, 100.

This mixture, melting at a temperature of 70° Wedgwood's pyrometer, is fused, and when cool it is finely pulverized. For application to the biscuit, it is triturated with water, which holds a considerable portion of the powder in suspension. The articles to be enameled are simply dipped into this liquid, a sufficient quantity of the powder adhering to the surface. When the external surface is to be enameled brown the vessel is first dipped into the brown enamel; after drying, it is filled with white enamel, emptied, and allowed to dry again.

When dry all traces of enamel must be removed from the bottom of the vessel, as otherwise, in baking, the bottom would adhere to the support. The enamel is removed from the bottom by means of brushes; this operation is very injurious to health, as it fills the air with fine particles of lead compounds, which are inhaled and swallowed by the operatives. This manipulation is called varnishing and brushing, and is illustrated in Fig. 2.

Fine faience goods must be placed in the oven very carefully. They are generally inclosed in muffles, made from biscuit, and these are placed on top of each other in the ovens; the latter holding about 20 to 30 of them, according to size.

Fig. 6 represents one of the chambers, containing several plates and a bowl in position.

By the application of heat the enamel is fused and partially penetrates into the biscuit, to which it imparts its color and a beautiful luster. The coating is hard, and does not crack or scale off when it is of good quality and properly prepared.

When articles are to be decorated by painting, the paint is applied to the enamel when the latter has become cold. The goods are then again moderately heated, by which the colors are firmly attached to the enamel. The pigments used are essentially the same as those used in porcelain painting.

"Fine" faience, properly so-called, is a product of modern times, and must be distinguished from the "common" faience just described. It consists of an inner white, opaque body covered by a crystalline lead glazing. The first "fine" faience was made in England, toward the end of the last century, by Wedgwood. It was he who discovered that silex is bleached by calcination, and that calcined silex bleaches clay. Pottery made from this material is very white and hard, ringing when, struck with a hard body, with a clear metallic sound. Its beauty and durability soon brought it into great demand, and for practical purposes it is to-day universally used in preference to its rivals. It was also called half-porcelain, opaque porcelain, and china, although originally the latter term was used to designate regular porcelain, china, or fine faience. It cannot be cut by steel, and differs from porcelain proper only by its opaqueness, the latter being translucent and more completely vitrified. China industry is of the utmost importance in Europe, especially England.

As stated above, the material consists of levigated clay and calcined silex, to which sometimes a little chalk is added. The glazing is of variable composition, but consists generally of oxide of lead, or minium, silex, feldspar, and soda. It is prepared and applied like ordinary enamel.

In England three varieties of china are distinguished: 1. Pipe-clay ware, containing a little chalk. 2. Stone ware. 3. Feldspar ware.

English pipe-clay, according to Schuhmann, is composed as follows: Clay, 86 parts; silex, 13; chalk, 1; total, 100.

The glazing for pipe-clay ware consists of: Sand, 31 parts; minium, 30; litharge, 27; calcined feldspar, 7; borax, 3; crystal glass, 2; total, 100.

Stoneware, according to Oppermann and Battenaire, consists of: Clay, 87 parts; silex, 13; total, 100; and is glazed with the following mixture: Silex, 42 parts; minium, 26; borax, 21; sodium carbonate, 11; total 100.

[*Continued on page* 258.]

Fig. 2.—APPLYING ENAMEL.

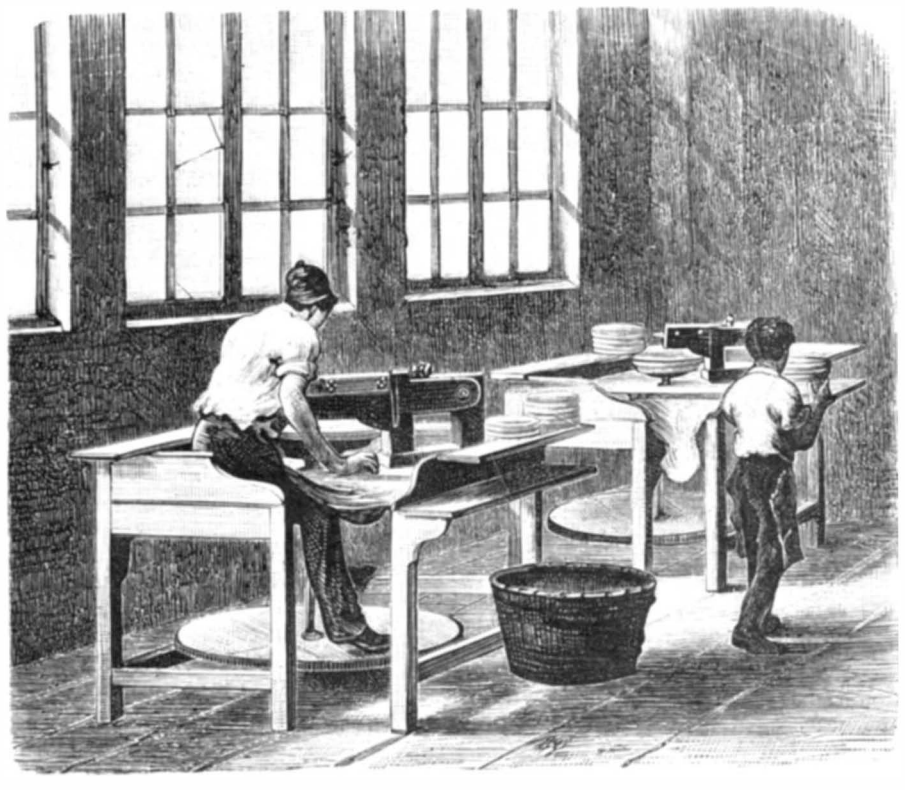

Fig. 3.—PLATE MACHINES.

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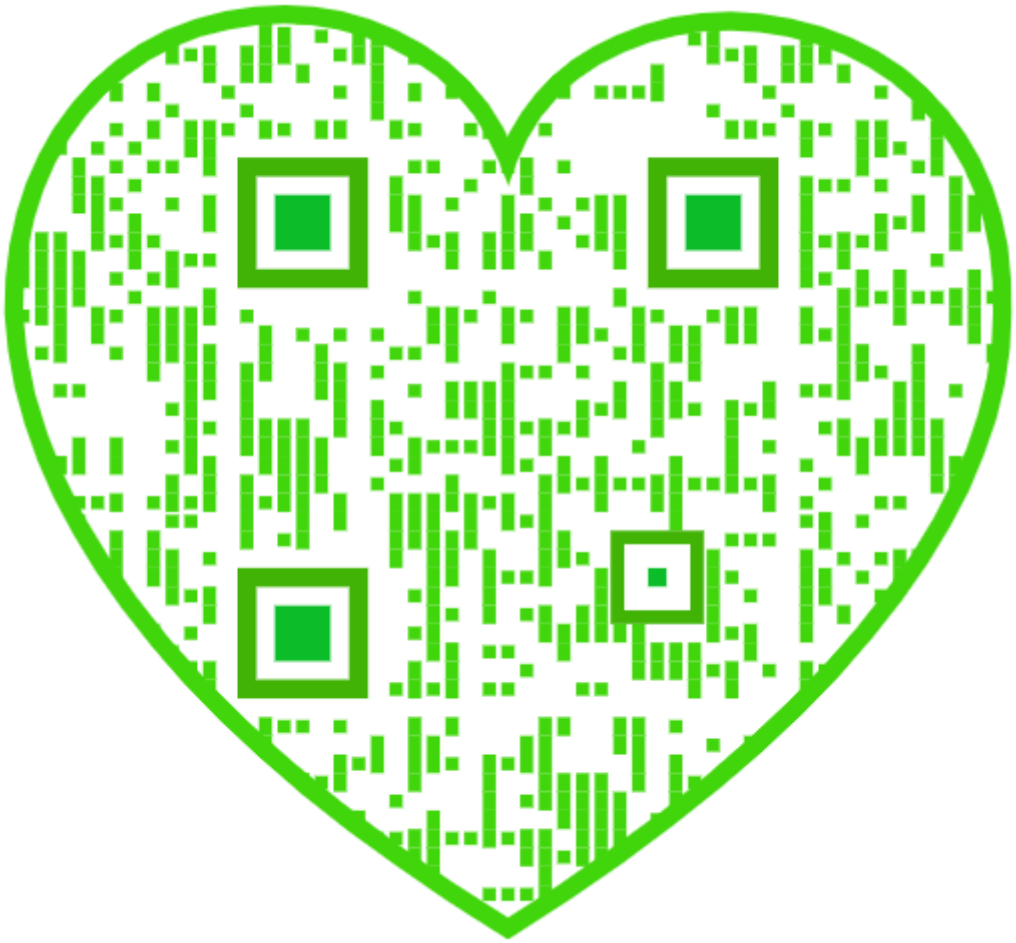

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THE SITE OF THE GREAT NEW YORK EXHIBITION.

The location of the buildings for the New York Exhibition of 1883 is just now the subject of much discussion. Though many conflicting interests are involved it is obvious that the question must be determined by a few paramount conditions.

Whatever local advantages may be offered by any or all of the suburban sites proposed, the single condition that the Exhibition must be easily and quickly accessible to the million people on New York Island, on foot as well as by horse or steam conveyance, should compel the selection of a site on the island and not above Central Park.

Accessibility by water from the surrounding cities, and convenience in handling materials as well as passengers, require that the site chosen should be near the water; the North River front offering by far the greater advantages.

As any money contributed by the city and State should be put into a permanent building (as was done at Philadelphia) the chosen location must comprise, in part at least, lands suitable for permanent occupancy by public buildings, and if possible already belonging to the city.

The temporary structures must be near the permanent buildings, and in a place suitable for the wholesome housing and accommodation of vast multitudes. In all probability the sites of such buildings must also be public land, since the enterprise could not afford to pay rent, and private citizens are not likely to contribute private property for such uses without remuneration.

Where can such a situation be found? The projectors of the Exhibition have pitched upon the lower part of Central Park, against the invasion of which the press and the public have very forcibly protested. It is true that the necessary damage to the park might not be so great as many fear; possibly the use of the Ball Ground and the Green (west of the Mall) might result in no permanent curtailment of those open spaces, and no injury except to the turf, which could soon be replaced. Nevertheless any invasion of the city's too limited breathing space, even temporarily or for the most laudable purpose, should be deprecated. From an artistic point of view the park would make an admirable setting for the Exhibition buildings; but the cost would, at the least, be altogether too great.

The city has already set apart for a museum and zoological garden the sixteen-acre area bounded by 8th and 9th avenues and 78th and 81st streets, and known as Manhattan Square. The plan of a magnificent structure there has already been perfected, and one wing built, making, so far as it goes, the best planned museum building in the world. The money contributed for a permanent building by the city and State of New York could be used in completing the central cross of this museum building. The rest of the plan might be developed as one story temporary buildings, giving, with the main building, 16 acres of exhibition space. Temporary structures covering 40 or 50 acres more will be required for the purposes of the Exhibition.

Instead of going into the park for sites for these buildings why could not the city utilize therefor the now unused roadways between Manhattan Square and the river, comprising four broad avenues intersected by cross streets at right angles, all as yet unoccupied, and all graded, paved, lighted, and drained by the city at enormous cost? A more convenient and wholesome situation for a great fair could not be found. The river front would accommodate all the shipping of the Atlantic coast. The Hudson River Railway and the two elevated roads traverse the region already, and could easily be made to furnish quick and comfortable conveyance for 300,000 visitors a day, in addition to the almost limitless facilities afforded by the river.

The crossing of 9th avenue by the Boulevard at 64th street would furnish an ample site for a vast building in the form of a St. Andrew's cross; the junction of the Boulevard with 10th avenue another site, equally good. Between 78th and 86th streets the Boulevard runs midway between 10th and 11th avenues. The three avenues with the cross streets would, anywhere in this neighborhood, furnish sites for Exhibition buildings surpassing in magnitude any ever dreamed of hitherto.

The diversion of the pleasure driving on the Boulevard to 9th or 11th avenue for a mile or so—the only inconvenience likely to accrue from the temporary occupation of the streets named by Exhibition buildings—would be as nothing compared with the evils and inconveniences sure to attend an invasion of Central Park. And the absence of immediate park surroundings to the buildings would be no serious objection to the proposed site for the fair, since it would be but a step from Manhattan Square into the park opposite the Lake and the Ramble.

The streets proposed to be occupied are of ample width for Exhibition buildings; the Boulevard is 150 feet wide, the avenues 100 feet, and the cross streets from 60 to 100 feet.

FROST AND YELLOW FEVER.

On the theory that yellow fever is propagated by germs which cannot withstand a freezing temperature, the United States Senate has passed a bill appropriating $200,000 for the construction of a steel refrigerating ship to disinfect the holds and cargoes of vessels coming from infected ports.

The projectors of this plan of disinfection claim that no mere experiment is contemplated. The project, they say, is sure to succeed, since artificial refrigeration is a simple and well established process, and it is certain that yellow fever germs cannot withstand frost; accordingly it is perfectly feasible to freeze out any possible yellow fever infection that vessels from the tropics may bring to our shores.

Unfortunately, however, these confident statements involve several hypotheses which sadly lack confirmation. The germs themselves are hypothetical. We have no positive proof of their existence as living organisms; still less proof that frost kills them. It is true that an undetermined something, under favorable conditions not wholly understood, suffices to propagate the disease. It is true also that yellow fever epidemics in this country are stopped by cold weather. Yet, while the fever is not apt to rage in any locality during two successive seasons, except in the tropics, the proof that frost is the arresting agent, and that it is able to put an end to the disease permanently (or until it is reimported) is very far from satisfactory. It is no uncommon thing for refugees from fever districts to return to their homes weeks after frost has set in, and then sicken and die of yellow fever. It is even asserted, on fair authority, that cases of sickness, which no one would hesitate to pronounce yellow fever during the summer season, have occurred repeatedly during the past winter in towns along the lower Mississippi; yet there has been no lack of severe frost in that region.

The recent outbreak of yellow fever on the United States Steamer Plymouth, after spending the winter at Boston, and being subjected to freezing and fumigation, complicates the matter still more. The Plymouth came to Boston last fall, from a cruise among the West Indies, with yellow fever on board. The vessel was free from the disease during the winter; and if there is any truth in the theory that frost is fatal to yellow fever, no cases should have occurred on that vessel without reinfection. Yet as soon as the steamer, which left Boston March 15, had arrived in southern waters (about 300 miles southeast of the Bermudas) fever broke out and the steamer was forced to return. But one stop had been made at St. Georges, Bermuda, where there has been no yellow fever for several years.

If the infection of yellow fever can withstand the winter climate of Boston, why should it not that of Memphis or New Orleans? If it can, the importation of the disease is not necessary to start an epidemic next summer, in which case the most thorough refrigeration of incoming vessels will not suffice to stay the plague.

There is another objection to the spending of so much money on an experimental vessel. If refrigeration should prove adequate for the disinfection of yellow fever ships, one refrigerating vessel will scarcely begin to do the work required in all our southern ports; twenty would be none too many. And why should a special steel ship be constructed to carry the simple apparatus needed for the production of cold? Any existing river steamer or fair sized tugboat would suffice for that purpose; and the $200,000 appropriated would fit up and charter a large number of such small vessels, each provided with all the machinery needed to refrigerate the hold of any vessel, should the experiment sustain the projector's theory. While two hundred thousand, or two hundred million, dollars would not be too much to pay for preventing an epidemic of yellow fever next summer, it is altogether too much to pay for an experiment which could be made for a tenth of the money, especially when there is a possibility that the wasted funds may be sorely needed in the practical application of the methods, the efficiency of which the experiment is expected to confirm.

THE AUSTRALIAN EXHIBITIONS.

The occurrence of two great Exhibitions in Australia, within a year of each other, is in some respects unfortunate; yet it may prove an advantage to exhibitors from this country and Europe, since it will be comparatively easy to transfer exhibits from the one to the other, and thus save the double ocean transit that would be required were the two Exhibitions more widely separated in time. Had Victoria and New South Wales united in a common exhibition, the display might have been grander, though it may well be doubted whether the commercial effect would have been so valuable. It must be remembered that Sydney and Melbourne are capitals of states together as large as France and Germany, and soon to be as populous; and in the absence of means of communication but few in either colony would be reached by an exposition at the capital of the other.

Though the smaller city, Sydney, has boldly taken the lead in inviting the world to compete for her trade, and will open the first world's fair south of the equator in September next, Melbourne follows in October, 1880. Like every other public work in New South Wales, the Sydney Exhibition is a government undertaking, and a large sum of money has been voted for carrying it out. The building is well advanced, and France and England have asked for more space than can be allowed. For American exhibitors there has been reserved 30,000 square feet on the floor of the main building, and half as much more for machinery. Already a considerable quantity of exhibits has been shipped from this port, and there is reason to hope that the United States will be creditably represented. It is proper to add that, with the exception of freightage, exhibitors will have no charges or commissions of any sort to pay. The space provided is free.

The foundation of the Melbourne Exhibition was laid February 19. The building is to stand in the center of a large public park—Carlton Gardens—on the highest land in the city, and is to cover seven acres; the whole Exhibition will occupy about twenty acres. The cost of the buildings and all expenses incidental to the Exhibition will be defrayed out of funds voted by the Victoria Parliament. Applications for space should be made not later than June 30 next. There will be no charge for exhibition space. American manufac-

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turers will not need to be urged to secure for themselves a favorable representation in these exhibitions. The Australian market is an inviting one, and American goods have been received there with signal favor.

THE BICYCLE AS A PRACTICAL ROAD VEHICLE.

Now that the interest in this means of locomotion is increasing in this country, the question, Is the bicycle a practical road machine? is often asked, especially by those whose experience with the velocipede of 1869 fully demonstrated the impracticability of that article for such a purpose. In relation to the subject, a correspondent sends us the following:

On January 7 last, the writer purchased a bicycle with 52 inch driving wheel; weight of machine, 44 lb. Since that date, for a period of eleven weeks, I have ridden it 350 miles over the common roads of this section (Essex county, N. J.), riding 26 days, and ranging from 20 minutes to 3 hours' riding time per day. The speed has varied from 6 to 17 miles per hour, and I have ridden without difficulty through slush, mud, and snow, and over ice, frozen ruts, and cobble stone pavement. All ordinary hills have been ascended with comparative ease; extraordinary ones, peculiar to mountainous regions, it has not been my fortune to essay. The fatigue occasioned by a long or swift run is surprisingly slight and transient. No stiffness or soreness follows the effort.

A few days ago your correspondent took a 16 mile run over roads and under circumstances which afforded a good test as to the utility of the machine. Starting at 5 P.M., a stiff hill was ridden down at a walking pace by "backpedaling," a curve at its base rendering it unwise to fly it. Three miles of lumpy, macadam road, very much out of repair, was succeeded by a better one, connecting with a common dirt road, which was slowly recovering from the effects of the winter season. This extended nearly two miles, and was ridden over slowly, but without trouble. Turning to the left, up the knubbly Montclair turnpike, I found the wind strong against me, so getting well over the handles, I climbed slowly for two miles to Montclair. Here I turned and ran down, making the two miles in 7 minutes. The final run home of six miles, including the muddy dirt road, occupied 30 minutes. No fatigue was felt after this run—the exercise manifested itself only in an amazing appetite.

IS THE MOON INHABITED?

The question as to whether the moon is inhabited by organic beings—if not like those that live on our own globe, at least of a kind specially adapted by their structure and nature for existing under the very different physical conditions that obtain on our satellite—is one that has attracted attention for ages, and one, too, that has been argued *pro* and *con* with great ability by many learned and eminent men. The opinion of nearly all scientists of the present day, however, is that the moon is a "dead planet;" and that, inasmuch as she has but a slight and very rare atmosphere, and that, as a consequence, no water exists on her surface, she is entirely unfitted to be the dwelling place of any organic beings whatever—at least of any kinds that our minds can form any conception of. On the other hand, those who take the opposite view argue (to use the words of Dick) that "matter appears to have been created chiefly in subserviency to mind; and it is highly improbable that the Creator would leave a globe containing a surface of 15,000,000 square miles altogether destitute of sensitive and intellectual beings, especially when we behold its surface diversified and adorned with such a vast assemblage of picturesque and sublime scenery, and when we consider that every department connected with our globe is peopled with sentient beings of every description. Although seas and rivers and a dense atmosphere are not to be found connected with the lunar orb, and although some of its arrangements are different from those of the earth, yet these circumstances form no valid objection to the moon being inhabited, for the Creator can in all cases adapt the inhabitant to the nature of the habitation provided for him, as he has adapted the birds for winging their flight through the air, the fishes for gliding in the water, and man and quadrupeds for traveling the dry land."

Among the noted scientists of the present day who hold this opinion, but who found it on the latest discoveries of science rather than on the wisdom of the Creator, is the celebrated French astronomer, M. Camille Flammarion, who is at present organizing a subscription for the purpose of founding at Paris a free observatory created by private means. M. Flammarion not only believes that the moon is inhabited, but he believes that it will be possible to construct a telescope of such power as to bring the lunar orb so near our eyes that the question may be practically settled. In connection with this project he has recently written a long and interesting article entitled "Is the Moon Inhabited?" in which he ably reviews all the facts bearing on the subject. This article, which we have translated from one of our French exchanges, will be found in SCIENTIFIC AMERICAN SUPPLEMENT No. 170.

INTEREST-BEARING NOTES.

By the failure of so many savings banks and trust companies throughout the country a great many persons have not only suffered severe losses, but a large number have been greatly distressed by the loss of all their accumulations, at a time, too, when they most needed them. Not only those who were unfortunate in having their money in these weak institutions have been sorely troubled, but depositors in solid companies naturally become apprehensive for the safety of their savings and withdraw their deposits.

While we do not recommend persons of small means to keep their money about their person or hid in a stocking under the bed to tempt thieves, there are a great many who do this, for the reason they have lost confidence in all savings institutions. To this latter class of persons the new ten dollar interest-bearing certificates, now being issued by the United States Treasury, will be found equally safe and convenient as gold or greenbacks for circulation, and interest on their investment will be constantly accruing, therefore they are better to hoard than either silver or gold.

These notes are convertible with accrued interest at 4 per cent per annum into 4 per cent bonds of the United States, issued under acts of July 14, 1870, and January 20, 1871, upon presentation at the office of the Treasurer, Washington, D. C., in sums of $50 or multiples thereof.

The certificates are a little shorter and somewhat wider than legal tender notes, which they otherwise resemble. A vignette of Benjamin Franklin is in one corner of the face side, with the figures and word ten in the other corner. They are dated April 1, 1879, and certify that the sum of $10 has been deposited with the Treasurer of the United States under act of February 26, 1879; this certification bears the signatures of the Treasurer and the Register, and the Treasury seal.

On the back of the certificate are the words "ten dollars," and the following: "Interest on this note will accrue as follows: For each 9 days, or 1-10 of a quarter, 1 cent; for each quarter year, 10 cents; for each entire year, 40 cents."

THE ANILINE COLORS.

Take a little of any of the brighter aniline colors on the point of a knife and sprinkle it on the surface of still clear water in a transparent vessel. Immediately lines of color will curve downward through the water, intersecting and blending till the whole vessel assumes the brilliant tint. Occasionally a little mass, more abrupt in its movements than the rest, will strike directly downward, but before it goes far it will divide and sub-divide and form an inverted tree of color in the liquid. Having reached the bottom it will sometimes start upward, as though it had accomplished its mission and had no time to spare on its return. Often a mass of colored liquid will take the form of the smoke rings of a locomotive, and sometimes two of these rings will chase each other downward, the one in advance opening and allowing the other to pass through, which in turn waits for its comrade, and so on till they are destroyed by frequent collisions. Some of the colors are very different when seen by reflected and transmitted light, and the blending of the two when the vessel is placed in different positions with regard to the sunlight is very beautiful.

What are these aniline colors, and whence are they procured?

It is surprising what a mine of wealth has been found in the refuse matter of our gas works. The bituminous coal, which is there heated in great retorts, yields much that can be utilized besides the gas upon which our cities are so dependent. Upon the retorts, as a crust, gas carbon is formed; this is a good conductor of heat and electricity, and supplies the carbon cylinders or plates used in several galvanic batteries, and also the poles for the electric light. Most of the devices for electric lighting require this product of the old system for their successful operation. The interesting scientific toy, the microphone, which renders audible the tramp of a fly, the rustling of the softest brush, the noises of insects far too faint to be distinguished by the unaided ear, uses the conducting power of gas carbon as a necessary agency. Certain vapors pass from the retorts and condense in the colder tubes. From some of these almost all the ammonia salts, so indispensable to the chemist and various manufacturers, are procured. The nitrogen of the vegetables of the old carboniferous age, now for the first time released from its long imprisonment in the coal, comes to us in the form of these ammoniacal liquors. Another liquid thus condensed is coal tar, while in the retort, after the volatile ingredients have been expelled, remains a hard material resembling anthracite coal, and which is useful for the same purposes as that article—coke.

We will take the coal tar and trace out some of the products which may be derived from it. No less than forty different materials have been extracted from this unpromising-looking article by the art and skill of chemists. When subjected to distillation it is separated into various substances, which are more or less volatile. By raising its temperature gradually, and collecting in different receivers the compounds that pass off, these may be obtained distinct from each other in tolerable purity. At about the temperature of boiling water, benzol, or benzine, distills. The use of this for dissolving grease is well known. As the temperature is raised there pass off in succession toluol, phenol, naphthalene, anthracene, increasing in weight and solidity, the last being a heavy greenish oil. In the retort is left pitch, which is extensively used in the construction of pavements. The benzol, when subjected to the action of strong nitric acid, forms nitrobenzol, the artificial oil of bitter almonds, which under the name of myrbane is an article of perfumery. By the action of hydrogen this nitro-benzol is converted into aniline. The second product of the distillation of coal tar, toluol, may be passed through a similar operation, the resulting product being toluidine.

We have now arrived at the basis of our aniline colors. From the thick black grimy coal tar are produced the brightest and most beautiful colors which art can show. The most gorgeous dyes, rivaling in beauty the tints of the rainbow or of the sunset clouds, are the coal tar colors. Surely, never was a stranger transformation; no substance could be found which at first sight would be accounted more utterly devoid of beauty than gas tar, and no stronger contrast could be seen than a bottle of it side by side with a transparent brilliant solution of aniline red, green, or violet. Many inks, both black and colored, are nothing but some of the products of aniline or its allied substances, dissolved in alcohol or water, and the brightly dyed ribbons of our streets are made beautiful, but often not permanently so, by the action of these marvelous coal tar colors.

It would not be interesting, except to a scientific man, to go over the various chemical changes by which aniline and toluidine are converted into the various colors. A combination of the two gives rosaniline, which is a kind of starting point in the manufacture. From this base, by the action of various acids, many of the colors are derived, while some are obtained from phenol and the other original products of coal tar distillation, though all are popularly but incorrectly known as aniline colors.

In the laboratory of the chemist the methods have been evolved and the products first obtained. Kept for a long time as a mere curiosity, their value as dyes was finally made known, practical men secured the secret of their manufacture, and vast industries, principally abroad, aggregating millions of dollars of capital, have sprung up. It is one of the many cases where the man of science, not for any mercenary purpose, but impelled by the love of investigation and discovery, has been a great material benefactor. Without his researches the grimy coal tar would have been grimy coal tar still, useful to paint fences, to preserve wood, and a few other minor purposes, but not suspected to be so rich a mine of wealth and beauty. One of the most brilliant discoveries of science in this line has been the artificial production of the coloring matter of madder. The dyeing quality of madder has been known for at least 2,000 years, and raising the plant and preparing the roots have been important industries in Zealand and many tropical countries. But recently two German chemists, working upon the known analysis of alizarine, a coloring principle of madder, have built up the substance itself, using as a base anthracene, one of the results of the distillation of coal tar. The artificial alizarine differs in no respect, chemical or physical, from the natural, possesses the same coloring properties, and its use has to some extent diminished the demand for the cultivation of madder. By what chemical process the plant, in nature's laboratory, forms its coloring principle we do not know; but we can trace every step of its formation from coal tar, and alizarine must henceforth stand side by side with safranine and the other so-called aniline colors.

It was about 50 years ago that Unterdorben separated from indigo a substance which he called crystalline, which afterward became known as aniline, from the Portuguese *anil*—indigo. Until within 20 years it was deemed an unimportant substance, indigo being itself too costly to support any extensive manufacture; but since it has also been found in coal tar a continued succession of coloring products has been drawn from this apparently inexhaustible source; one of the latest of these has been uranine, a beautiful green fluorescent dye.

The aniline colors are not permanent. We have heard of the labels of boxes which were marked with aniline inks becoming entirely white, no vestige of a letter remaining, upon exposure to the sunshine in the transit, to the manifest inconvenience of the expressman. The writer having occasion to use some charts, made them partly with ordinary black ink and partly with crimson. In course of time the crimson faded away, leaving the black characters rather meaningless by themselves; and this in a position where no direct sun rays ever reached.

Some of them are, however, much more permanent than others, and for purposes which do not involve great exposure or rough usage they answer very well, while their brightness gives the dyer a power he cannot possess with the fast colors. Magenta, mauve, solferino, roseine, Tyrian purple, picric acid, and many others, enable him to add immensely not only to the brilliancy but to the variety of his shades.

The extensive employment of these colors in many articles of ordinary use has led to numerous experiments on their physiological effects on the human system. Pure aniline is a strong poison in the stomach, and both aniline and nitrobenzol, when taken into the lungs in a state of vapor, are very injurious. Numerous instances of serious impairment of the health of workmen employed in aniline factories are on record. In one case a workman broke a carboy of the liquid, and in wiping it up respired a large amount of the vapor; in a few hours his face and body assumed a leaden hue; his gums, eyes, and lips a bluish appearance from the formation of coloring matters in the blood, and the whole system was seriously deranged. Energetic treatment, however, saved his life. But the aniline colors, which are not pure aniline, are much less injurious. They adhere so closely to the dyed fabrics that there is no danger of their floating as dust in the air, as in the case of arsenical dyes, and when pure are but slightly poisonous even when taken internally, though hurtful substances, like arsenic, lead, and mercury, are used in the manufacture, and may exist in a greater or less degree in the colors themselves.

AN ingenious apparatus, intended to reproduce telegraphically at a distance the pictures obtained in a camera obscura, has, says *Galignani*, recently been invented by M. Senlecq, of Ardres. The principle on which it is based is the property possessed by selenium of presenting a very variable and very sensitive electrical resistance according to the different gradations of light.

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[*Continued from first page.*]

Feldspar ware, according to St. Amand, consists of: Clay, 62 parts; kaolin, 15; silex, 19; feldspar (decayed), 4; and covered with the following glazing: Oxide of lead, 52 parts; kaolin, 25; silex, 13; crystal glass, 10; total, 100.

The machines used for shaping fine faience are identical with those used for ordinary faience. For some articles which are manufactured in very large quantities, as plates, special machines have been devised.

Fig. 3 represents a plate machine. The shaft of the wheel carries at the top a circular block of wood, forming the counterpart of the inside of a plate. A sufficient quantity of clay, rolled so as to form a sheet of the required thickness, is placed upon this block and pressed down closely. To a standard is attached the shaping tool or "caliber," movable in vertical direction. Its profile at the lower edge corresponds exactly to the external form of the plate. By causing the wheel to revolve slowly, the plate is brought into the desired shape.

For forming articles not of circular shape or otherwise difficult to form, moulds of plaster of Paris are used. These, when dry, rapidly absorb the water from the clay and cause it to harden rapidly.

To bake the biscuit, the temperature must be brought up to about 100° Wedgwood's pyrometer; for enameling, 10° to 30° are sufficient.

Although not strictly belonging to the faiences, we may nevertheless mention in connection with it the so-called "gray pottery" (grès-cérames). It consists of dense, heavy material, which rings with a metallic sound. It is opaque, of a finely grained texture, and sometimes nude, sometimes glazed with a mixture of salt, oxide of lead, and silica.

Ordinarily it receives a sort of vitreous covering all over the surface, consisting of silicate of sodium and alumina, during the first baking, and a repetition of this latter operation is thus rendered unnecessary. The purpose is accomplished by simply mixing sea salt with the fuel used for baking. The salt evaporates, and the vapor, coming in contact with the heated articles, decomposes; the sodium oxide and the various other oxides generally contained in sea salt unite with the

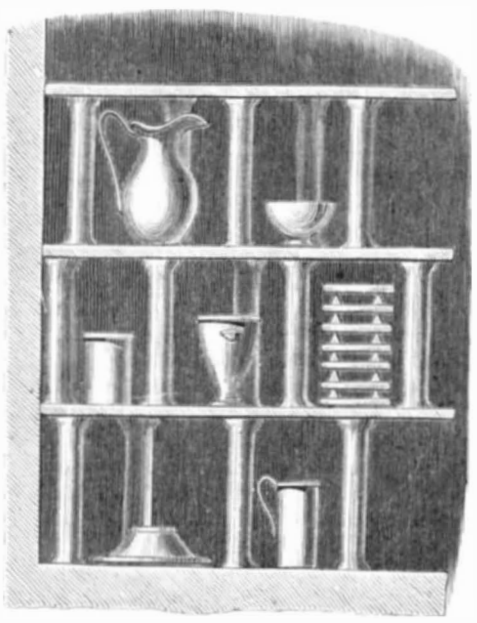

Fig. 4.—POSITION OF ARTICLES IN OVEN.

silica of the vessels and form a glass, which penetrates into the pores of the clay and renders it impermeable and glossy. This simple process is the invention of Wedgwood. 100° to 120° of heat (Wedgwood) are required to finish it. Fig. 7 represents an oven used for baking gray pottery. The articles to be baked are placed on Wedgwood shelves.

Gray pottery is very hard and brittle. It cracks frequently on sudden changes of temperature and when directly exposed to the fire. This quality of ware may be white or colored. The following is the composition of the material used in its manufacture:

White.—Kaolin, 25 parts; clay, containing a little kaolin, 25; feldspar, 50; total, 100.

Colored.—Kaolin, 14 parts; clay, 14; silex, 15; pegmatite (decayed), 27; sulphate lime, 21; sulphate of baryta, 9; total, 100.

Black.—Kaolin, 2 parts; clay, 48; calcined ocher, 43; manganese (black), 7; total, 100.

Gray pottery was manufactured extensively thousands of years ago by the Chinese and Japanese. A Japanese vase is exhibited at the Louvre, 2½ feet high and 2 feet wide, which was manufactured at Meissen by Boettcher, previous to the invention of porcelain.

BLASTING BY COMPRESSED AIR.

The risk attending the use of gunpowder or other explosives in coal mines has led to the trial of compressed air for breaking down coal, experimentally that is, and the experiment seems decidedly promising. A small portable machine was used, by which two men were able to compress air so as to give a pressure of 14,200 lb. to the square inch. The compressed air was conveyed through wrought iron pipes to a cast iron cartridge, 12 inches long, placed in a hole drilled in the coal; into this cartridge the air was forced until it burst, breaking down the coal. A pressure of 9,550 lb. to the square inch was found sufficient to break down hard coal.

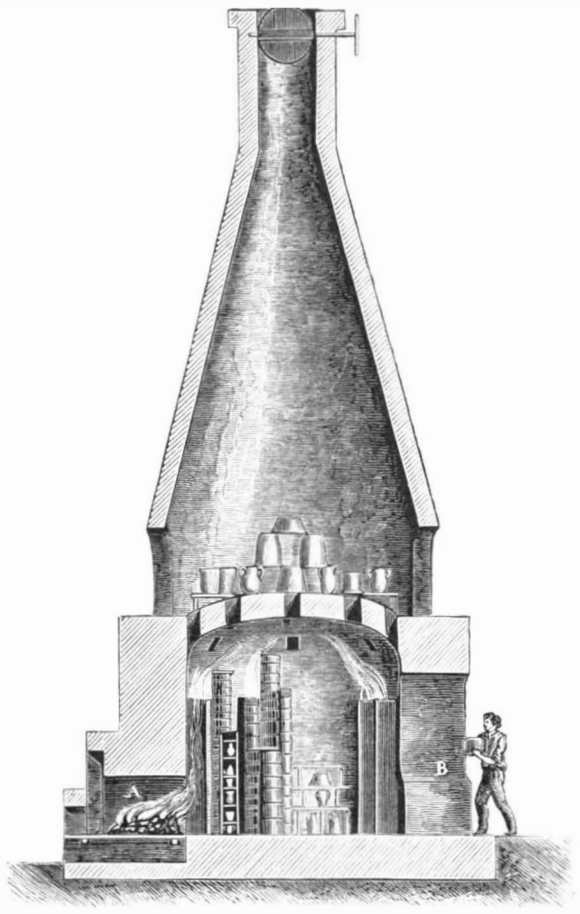

Fig. 5.—OVEN FOR BAKING AND ENAMELING.

In a paper lately read before a meeting of coal miners, at Manchester, England, one of the inventors of this system, Mr. W. E. Garforth, of Dukinfield, expressed the conviction that before long a pressure of ten, fifteen, or twenty thousand pounds per square inch would be so utilized that they would be able to put into the miner's hands a power that would enable him to get out coal, without risk, either from blown out shots, explosions, or the production of deleterious gases.

Comparing the two systems of breaking down coal—by gunpowder and by compressed air at 8,000 lb. pressure per square inch and upward—Mr. Garforth thought that the latter would be nearly, if not quite, as expeditious as the former, while it possessed many signal advantages, especially in the matter of safety.

Remedies for Biliousness.

Dr. Rutherford says: "As yet we have found 4 grains of iridin a certain remedy for biliousness. It may be made into a pill with confection of roses, and taken at bedtime. It produces no disagreeable sensations, and on awaking in the morning the yellow tongue is clean, and the headache and *malaise* are gone. As iridin, though a powerful hepatic, is not a powerful intestinal stimulant, it is well to give in the morning an ordinary mild saline aperient, such as Püllna water. Iridin, though an agreeable remedy at the time, has a somewhat depressing effect, and it probably should not be taken much oftener than once a week."

Dr. Rutherford also states that "euonymin is a hepatic stimulant in man as it is in the dog. Two grains of it made into a pill with confection of roses, and taken at night, seem to be as efficient a remedy for biliousness as iridin. If the dose be not too great it leaves no depression. A dose of a saline aperient should be taken in the morning. I have been much struck with the success of euonymin in functional derangement in several persons who had tried nearly all the commonly used cholagogues with varying and often limited success. I have no doubt that in consequence of our experiments euonymin will come to be a universally employed hepatic stimulant."

The Spectrum of Brorsen's Comet.

Professor C. A. Young, of Princeton, writes to the New York *Times* saying that Brorsen's comet has not an exceptional spectrum, as indicated by Huggins' observations of 1868, but falls into line with all the other comets. Professor Young's observations were made upon the evenings of April 1 and 2, and a comparison between the spectrum of the comet and that of the flame of a Bunsen burner showed a coincidence exact within the limits of observation.

RECENT AMERICAN PATENTS.

An improvement in oil stills has been patented by Mr. Clark Alvord, of Kendall Creek, Pa. It consists in a series of metal rods arranged permanently in the bottom of a still, and projecting downward toward the fire and upward into the oil. The object is to thoroughly distribute the heat through the oil.

An improved soldering machine, patented by Messrs. Joseph W. Miller and Bernard Coll, of Baltimore, Md., is designed for rapidly soldering the tops and bottoms of cans, pails, etc. It has novel features, which cannot well be described without an engraving.

An improved water elevator, patented by Mr. A. W. Coates, of Alliance, Ohio, is provided with a weighted plunger, which, by its descent, forces water up through a stand pipe.

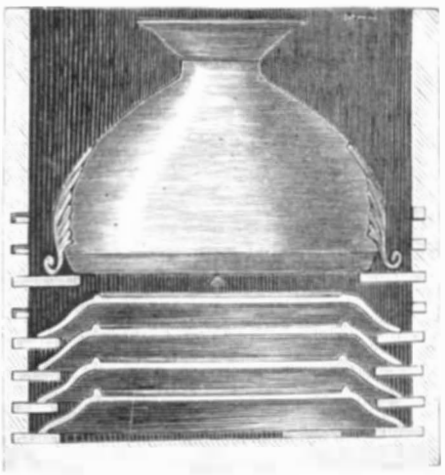

Fig. 6 INTERIOR MUFFLE.

Mr. W. E. Washburn, of Sackets Harbor, N. Y., has patented an improved hampering pad for horses, which consists of two plates, one carrying points, which stand opposite perforations in the other, when they are in their normal condition pressed apart by a spring. When the horse presses against a fence or other object with his breast he is pricked by the points.

Mr. C. S. Piersons, of Sandy Hill, N. Y., has patented an improvement in harness, which renders it stronger, lighter, and more durable, and less expensive than ordinary harness. Its construction cannot be described without an engraving.

A compact and convenient receptacle for holding flour for household use, has been patented by Mr. Joseph Johnson, of Marshalltown, Iowa. The invention consists in a cylindrical receptable having a grid for supporting the body of the flour, and a rotary sieve for sifting it and delivering it to a chest, upon which the receptacle rests.

Mr. G. D. Eighmie, of Poughkeepsie, N. Y., has patented an improvement in men's drawers, which consists in cutting the

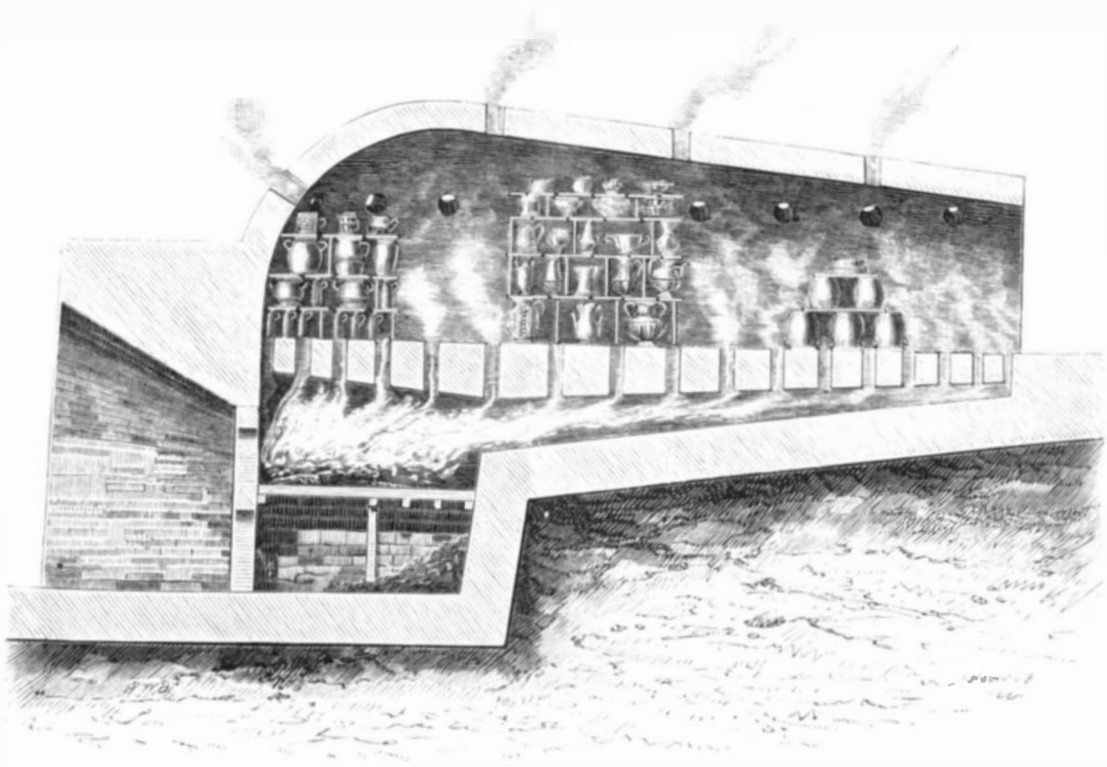

Fig. 7.—OVEN FOR GRAY WARE.

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material so that each leg portion shall have a single lengthwise seam on the back. The cloth is cut on a bias to secure elasticity.

An improvement in lanterns, patented by Mr. Patrick J. Clark, of West Meriden, Conn., is designed to prevent the disturbance of the flame by currents of air, and to keep the top of the lantern cool.

Mr. Josiah Watts, of Brooklyn, N.Y., has patented a fan driven by a spring and clockwork. The stroke of the fan may be lengthened or shortened, and its velocity may be varied.

An improved car axle box lid, patented by Mr James Seath, of Terre Haute, Ind., is fitted to the end of the oil box, which is made convex and provided at each side with tongues, which fit in grooves in the ends of the cover.

Mr. Charles H. Fuller, of Akron, Ohio, has patented an improved stuffing box for piston rods, in which the old packing may be retained, when new is added. The invention consists in a hollow gland having a conical interior, which receives a portion of the packing.

An improved windmill regulator has been patented by Enos C. Daniels, of Lyons, Ohio. The invention consists mainly in a vane which holds the windmill out of the wind, excepting when force is applied to it. It is a simple device for controlling the action of the mill.

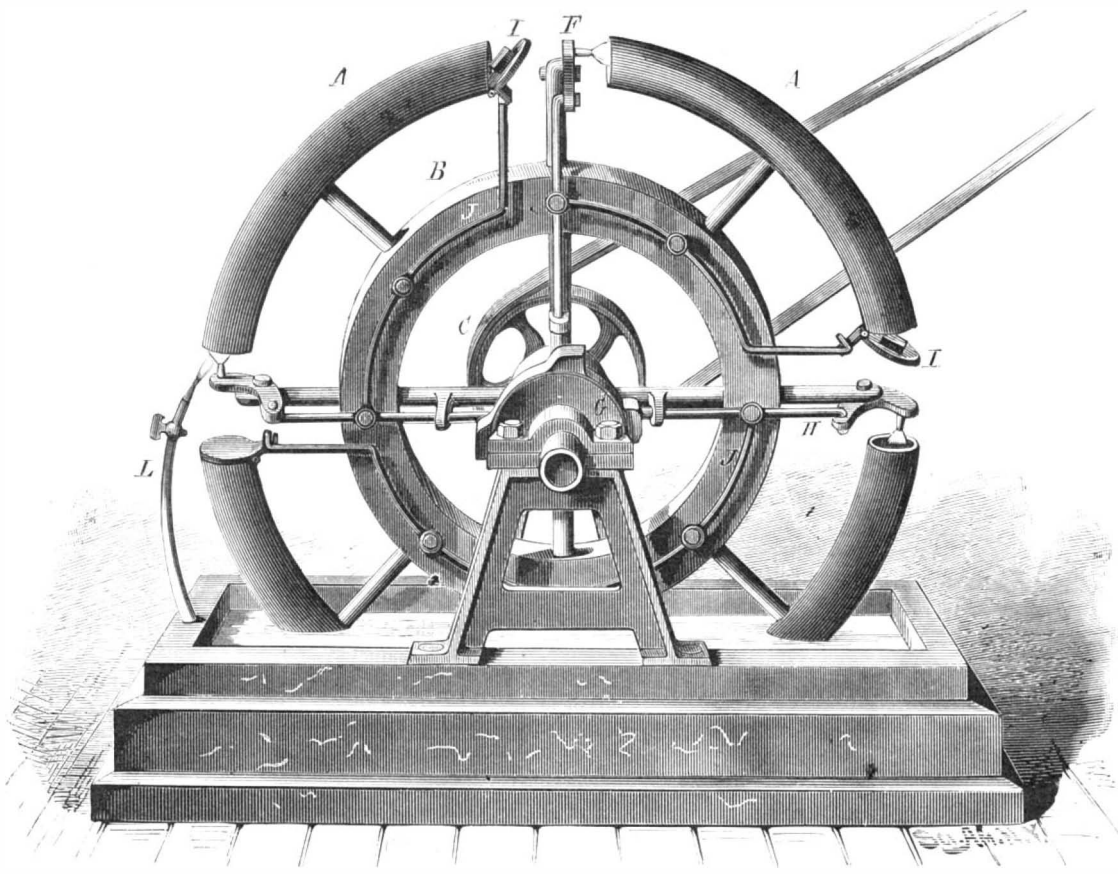
A NOVEL ROTARY ENGINE.

We give herewith an illustration of a rotary engine of novel character, which the inventor, Mr. Lorenzo B. Lawrence, of Monticello, Cal., calls a rotary vacuum engine. It consists in an arrangement of curved tubes, A, which are open at both ends, and supported by a wheel, B, secured to a hollow shaft, and having tubular spokes, which project beyond the periphery of the wheel into the spaces between the curved tubes, A.

The hollow shaft is supported by plumber blocks, which rest upon the sides of a water tank, into which the curved tubes dip. One end of each curved tube is always left open; the opposite end is provided with a valve, I, which closes automatically as the open end touches the water. Opposite the open end of each curved tube there is a gas burner, F, which is pivoted to one of the tubular arms of the wheel, B, and is moved by a cam, G, attached to the plumber block. This burner receives gas through the hollow shaft and arms of the wheel, B. The valves, I, are operated by the same cam through the levers, J.

The pivoted burners are arranged with reference to a continuously burning stationary gas jet, L, so that the gas is let on as they come opposite the stationary jet, the latter serving to ignite the gas as it issues from the pivoted gas burners.

As the mouth of the curved tube nears the water the valve, I, is closed, and the burner, F, is turned aside, shutting off the gas supply. By the heat of the gas flame the air is rarefied in the tube, B, and as the tube strikes the water, the air is cooled, forming a partial vacuum, which draws the water into the tube causing that side of the wheel to preponderate, and inducing a rotary motion, which is continued so long as the gas is supplied and ignited in the manner described.



LAWRENCE'S ROTARY ENGINE.

A New Explosive.

The staff of the Austrian artillery have been for some time engaged in making experiments at the arsenal of Zamky, says *Galignani's Messenger*, on a material which is said to possess far greater explosive power than any other substance hitherto discovered. During a series of investigations relative to dynamite and compressed gun cotton, M. Nobel found that the latter could be prepared in such a way that it could be completely dissolved in nitro-glycerine. The product is a gelatinous and gummy substance which, at the highest pressure, does not part with any of the nitro-glycerine. That explosive gelatine resists water, cannot be fired by any shock, but only goes off with difficulty and imperfectly when ignited. Further experiments showed, however, that with it a new compound could be formed, admirably adapted to all military purposes. This is prepared by simply adding a little camphor to the gelatine. The proportions are 4 per cent of the former to 96 per cent. of the latter, which consist of 90 per cent of nitro-glycerine and 10 per cent of fulmi-cotton. The gelatinous mass is elastic, transparent, of a pale yellow color, and can be cut with a knife. When set on fire in the open air it burns like dynamite or dry compressed gun-cotton. It only takes fire at a very high temperature, and the action of the camphor is very evident in that respect, for the ordinary gelatine by itself explodes at 200° Centigrade (392° Fahrenheit), while the heat required to produce that effect after the addition of the camphor cannot be tested by any of the apparatus usually applied to that purpose. The new composition cannot be fired by a blow, even from a projectile; it shows no sign of alteration even after having been left in running water for 48 hours. When solidified by cold it forms a mass resembling sugar-candy, and is then more sensitive to mechanical action, but as soon as it is thawed it resumes all its original properties. When exploded, however, it produces less smoke than dynamite or gun-cotton, with a clearer and more sonorous report, and has far greater force than either. The principal objection to its adoption was the difficulty of igniting it, but that has been overcome. When cotton fiber is subjected to the action of sulphuric acid, a white pulverulent substance is obtained, which has received the name of hydro-cellulose, is easily soluble in nitric acid, when it becomes nitro-hydrocellulose. This compound, mixed in the proportion of 40 per cent with 60 per cent of nitro-glycerine, forms the most powerful means of ignition ever hitherto discovered. By properly constructed firing-cartridges of that substance the explosive gelatine becomes as manageable as ordinary powder, with less danger and far greater expansive force.

A Thriving State.

In reporting on the iron and steel industries of Belgium, as represented at the Paris Exhibition, Assistant Commissioner J. D. Morrell says that there is something amazing in the comparative prosperity of the Belgian iron and steel industries, when their spare natural resources are taken into consideration, and when the same industries of more favored countries are experiencing a greater or less depression. The causes for this condition of things, Mr. Morrell says, are to be found in cheap labor, long hours, the technical education of workingmen, strict economy in administration, attention to minutest details, and use of the most improved labor-saving machinery. The population of Belgium is very dense, 5,000,000 people inhabiting 12,000 square miles of territory. The country is a hive of industry. There is no room for drones. Every man has his work to do, and he must be content with small wages, for high wages would soon put an end to all employment by destroying the ability of Belgium to compete in foreign markets. Strikes are exceedingly rare, and when they do occur they are soon terminated, because the Government will not tolerate them. Personal economy is essential to existence. The labor of women and children is utilized. Railroads through its own territory, favorably situated seaports, and a trading spirit handed down from the middle ages, aid in securing foreign purchasers for Belgian manufactures. Belgium utilizes all her resources. She is industrious and frugal. She neglects none of her opportunities. Mr. Morrell concludes this portion of his report by the remark that much of the distress existing in other countries might be obviated by the practice of the same virtues, and that it would not involve the reduction of wages to the Belgian standard.

Profits on Beer and Milk.

According to the English newspapers, the depression of trade in Great Britain does not extend to every industry. The celebrated brewers, Bass & Co., it is stated, divided as profits for the year 1878 the almost incredible sum of £400,000. The Anglo-Swiss Condensed Milk Company, it is also stated, divided a profit of £60,000. The alarm in London respecting the milk served from infected cows, it is said, has largely increased the trade in condensed milk within a short time.

It would seem, therefore, that while the metal trades and some of the other important industries of the country are greatly depressed, the articles of food and drink are paying a good profit to the dealers.

Iron in New Zealand.

The Government of New Zealand has, within a few years, constructed more than one thousand miles of railroads within its colony, all the material for which, except the sleepers, having been transported, at heavy cost, from England. The present Minister of Public Works, Mr. James MacAndrew, has undertaken the experiment, with a view of promoting the iron industry of the colony, of advertising for proposals for one hundred thousand tons of steel rails, to be made from the native ores of New Zealand. In addition to the advertisement in another column, a pamphlet has been printed by the Government containing maps and diagrams, which may be had from Sir Julius Vogel, Agent of the Colony, on application at 7 Westminster Chambers, London.

Around the World in Thirty Days.

In a letter to the *Herald* detailing some of his plans for the coming summer, Mr. Samuel A. King, the aeronaut, says that during his thirty years' study of aerial navigation, in the course of which he has made somewhat over two hundred ascensions, without injury to life or limb, he has steadily endeavored to avail himself of whatever experience or suggestion might afford to make traveling in the air practical, definite, and useful. Numerous and often costly experiments have shown him that, with no mechanical appliance or power yet discovered, is it possible to journey definitely and with certitude through the air to any previously designated point, in opposition to the direction of a prevailing wind. The balloon, therefore, remains to-day what it was in the days of the Montgolfiers, a machine that all the skill and ingenuity of man cannot prevent from floating with the wind, which controls and directs it absolutely from the moment it is launched. The application of any known mechanical power, to be of any use as against a wind directed upon the vast surface of a balloon, is entirely impracticable in consequence of the weight involved. Mr. King is confident, however, that a great deal can be accomplished with the balloon, slave to the wind though it be, and that it is possible to operate them so as to greatly prolong their carrying ability. As the result of a long series of experiments Mr. King speaks confidently of his ability to make a balloon voyage of a month's duration, a time sufficient, with a thirty-five mile breeze, to circumnavigate the globe; and he claims to have demonstrated to his own satisfaction that it is not only feasible to construct a balloon that will maintain the bulk of its lifting power, but that it is also easily practicable to keep it afloat and in transit for this length of time.

Mr. King proposes to operate during the coming summer a spheroidal (captive) balloon, having a diameter of 65 feet and a capacity of 150,000 cubic feet, inflated with hydrogen, maintaining a second balloon of like dimensions as a reserve in case of accident. If his experiments with these are satisfactory he proposes to construct an air ship double the size of his captive balloon, for a transatlantic voyage, to be undertaken "in earnest," some time in 1880, following the well-established storm path on which the *Herald* bases its European weather forecast.

The Sizes of Ferments.

The *Brewer's Guardian* has compiled from trustworthy authorities the following table, showing the sizes of the various ferments found in beer and other fermented liquors:

	Diameter of the Cells in Fraction of an Inch.
Saccharomyces cerevisiæ	·00031 to ·00035
" minor	·000315
" ellipsoideus	·00024 by ·000176
" pastorianus	·0007 by ·00035
" exiguus	·00098 by ·000118
" apiculatus	·000236 by ·000118
" mycoderma	·000118 to ·000787
Viscous ferment	·000047 to ·000055
Lactic "	·0000984
Butyric "	·0000687 by ·000687
Mycoderma aceti	·000059 by ·000118

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EDISON'S ELECTRO-CHEMICAL TELEPHONE.

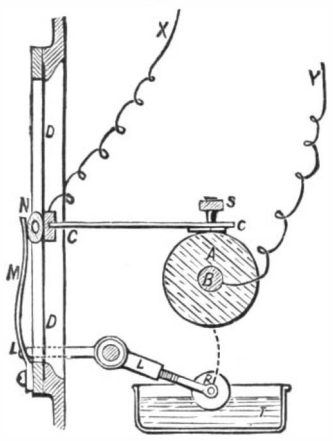
Mr. Edison has recently improved his carbon telephone so much that in conjunction with a magnetic receiver it far surpasses for power and clearness of articulation every other system of telephone that has been introduced.

As long, however, as there was in connection with the instrument no more powerful receiver than the Bell telephone or instruments of similar principle, the carbon telephone, although possessing many points of superiority over other systems, was limited in its power to the capabilities of the receiver with which it was connected, and until quite recently no receiving telephone had been introduced which would develop or do justice to the power of the carbon transmitter.

Mr. Edison has now applied, with remarkable success, the principle of the electro-motograph to the construction of a telephone receiver, which, on account of its extraordinary power and perfection, must before long supersede the feeble instruments of other systems, and secure to itself a great commercial future. No one who has heard this new telephone can fail to have been astonished at its clear, articulate, and loud tones; it might appropriately be called "The Shouting Telephone," for its "voice" is louder than that of any ordinary speaker, and we have failed to distinguish any difference in clearness of articulation between its utterances and those of a person engaged in conversation. Where it is in use it is of course unnecessary to go at all near the instrument, for it may be fixed against the wall of an office, and its messages heard at any part of the room spoken in a loud clear tone, and even the high notes of whistling are reproduced with such perfection as to make it almost difficult to believe that some one in the room is not whistling loudly near the instrument.

This extraordinary instrument, which is illustrated in Figs. 1, 2, 3, and 4, consists in its simplest form of a diaphragm which is set into vibration by the variations of friction taking place between a metallic strip and a chemically prepared rotating cylinder, under variations of the strength of an electric current passing at the point of contact of the metallic strip and the cylinder. In its simplest form the apparatus consists of a cylinder composed of chalk and potassium hydrate with a small quantity of mercury acetate moulded round a flanged roller or reel of brass, which is lined with platinum on those surfaces which are in contact with the mixture, which is kept in a moistened condition. Upon the upper circumference of the cylinder, which is caused to revolve on a horizontal spindle, a metallic strip is caused to press with a firm and uniform pressure by means of an adjustable spring. The portion of the strip which bears upon the cylinder is lined with platinum, and the opposite end is attached to a diaphragm of mica, four inches in diameter, firmly fixed by its circumference. The cylinder is

FIG. 3.



connected to the copper element of a battery, and the strip to the zinc pole, with a transmitting telephone included in the circuit. If, when no current is passing through the instrument, the cylinder be rotated at a uniform speed away from the diaphragm, the friction between the cylinder and the strip causes the diaphragm to be drawn inwards, that is, toward the cylinder, and the diaphragm would take up a fixed position dependent upon its own rigidity and the friction between the cylinder and the strip. The instant, however, that a current is transmitted through the instrument that friction is reduced and the diaphragm flies back by its own unopposed elasticity, the variation of friction being proportional to the variation of the strength of the electric current; and so marvelously sensitive is this combination that the variations in the strength of the electric current caused by the human voice speaking against a carbon transmitting telephone instantly produce their corresponding variations of friction, and the diaphragm repeats the words, but very much louder than they were originally uttered at the distant station.

Fig. 1 is a perspective view of the apparatus, which is in reality three instruments in one, combining a transmitter, receiver, and call bell, and, therefore, has a somewhat complicated appearance. The whole of the upper portion, however, is the call bell and signaling apparatus, by which attention is attracted at the other station, and by which such calls are received; this differs in no respect from an ordinary electric bell, having a key and switch by which it is thrown into circuit. In front of the box, which is of cast iron, is seen the large diaphragm, but even this has a more complicated appearance, in consequence of the transmitting carbon telephone being fixed in front of, and concentric with it. If the transmitter and call bell apparatus were removed, the

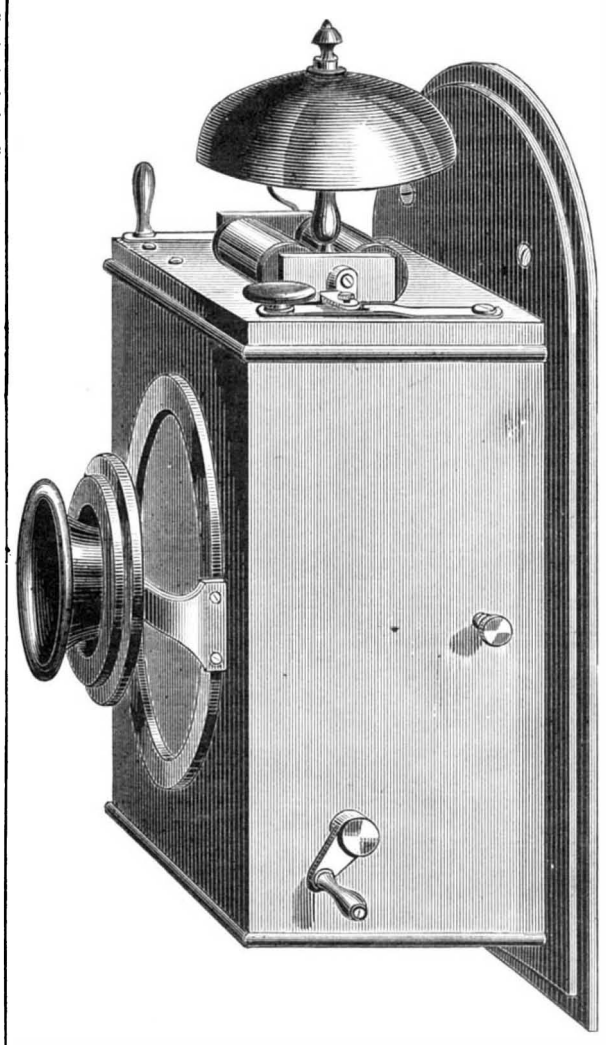
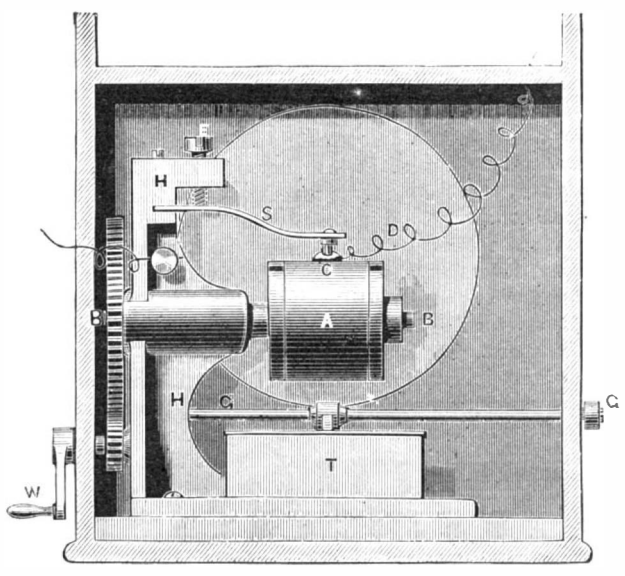


Fig. 1.—EDISON'S ELECTRO-CHEMICAL TELEPHONE.

external appearance of the receiver would resolve itself into a rectangular box, having a 4 inch hole in its front face glazed with mica, and a small winch handle projecting from the right hand side. The internal arrangements are shown in Fig. 2, which is a back view of the interior, and in Fig. 3, which is a vertical section taken through the center of the diaphragm. Referring to Fig. 2, A is the chalk cylinder mounted on the horizontal shaft, B B, which, by a spur wheel and pinion, can be rotated at a moderate speed by turning the winch handle, W. The spindle, B, turns in, and is supported by the long boss bearing shown in the figure, and which forms part of the cast iron bracket, H H, to which every part of the apparatus, except the diaphragm and its connected strip, is attached. D is the diaphragm, which consists of a disk of thick mica, 4 inch diameter, and C is a metallic strip attached to its center, and which is pressed tightly against the upper portion of the cylinder by means of the stiff spring, S, whose pressure can be regulated by the screw, E. A comparison of Figs. 3 and 4 will make the arrangements of parts clear. G is a countershaft, which can be turned through a small angle by depressing a lever keyed on to it on the outside of the case; the effect of this is to raise, by means of the forked lever, L L, the damping roller, R, against the surface of the chalk cylinder, and so occasionally to supply the water which is lost by evaporation. The roller, when not in use, rests in a trough of water, T,

FIG. 2.



and has only occasionally to be raised when the cylinder becomes too dry to give the best results. When this instrument is connected to a carbon telephone, with no greater battery power than two Fuller cells, any sound uttered into the transmitter is not only perfectly reproduced by the mica diaphragm, but its sound is so greatly increased as to constitute what in a speaker would be considered an unusually loud voice.

Mr. Edison has found that this instrument, like the magnetic receiver, produces far more satisfactory results when working on an induction circuit than when it is connected directly with the carbon transmitter; he therefore adopts the plan of placing the receiving instrument in circuit with the secondary wire of an induction coil, the transmitter and battery being on the primary circuit. Fig. 4 will explain how the connections are made for a single pair of instruments. In this diagram T is the carbon transmitter and R the electro-chemical receiver, B is the battery, and C an induction coil. The undulatory character which is given to the voltaic current by transmission through the carbon disk, whose resistance is continually varying under the influence of sonorous vibrations, produces by induction a correspondingly undulatory current in the secondary circuit of the induction coil, C, and this varying current being transmitted by the line wire to the receiving instrument, by varying the intensity of electro-chemical decomposition going on between the chalk cylinder and the platinum point which presses on it, causes a corresponding variation of the coefficient of friction between the two surfaces.

The secret of the great power of the instrument, by which it speaks with a voice to be distinctly heard all over a large room, is that the mechanical motion of the diaphragm is produced not by the electric current, as in all other telephone receivers, but by local mechanical means, such as a train of clockwork or rotation by hand; the electric current merely controls the time when that mechanical force is exercised, and the amount which is brought into play. It may, mechanically, be compared to a frictional coupling or clutch through which a machine is driven by a steam engine, and which at any moment may be made to transmit the full power of the motor to the machine, or by varying the friction to transmit only a portion of that power.

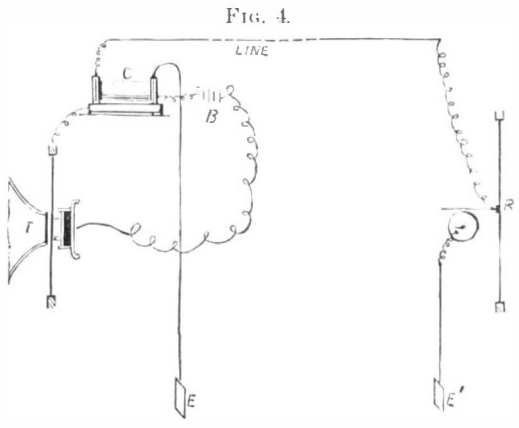
Swine in the United States.

A review of the pork packing season in the West, published in Cincinnati April 3, shows the number of hogs packed during the year ended March 1 to have been 10,858,692, an increase of 1,810,126 head over the preceding year. According to a statement of the Commissioner of Agriculture, the number of hogs in the country at the beginning of the present year was nearly 35,000,000; over 2,500,000 more than was reported the year before.

Snakes as Pets.

Of all ungrateful, ill-conditioned, disagreeable reptiles, the black snake takes the lead, and, with the exception of the

FIG. 4.



common water snake, is the most pugnacious of all serpents I ever handled; it would bite fiercely when caught, and, further, it would bite in captivity whenever the temptation offered. We could not tame it to any extent until, by beating it smartly and repeatedly, we at length succeeded in getting it to a state of sullen, reluctant decency. Its bite caused some blood to flow, but otherwise amounted to nothing. The water snake (*Nerodia sipedon*) was as snappish and unappreciative of kindness as the black snake, would bite when first captured and also afterward during captivity, though in this latter state not always, but as the caprice seized it. The copperhead (*Ancistrodon contortrix*) we had only in two instances. One was brought to us half dead, and died the same evening. The other we captured alive by placing the foot (well booted) on the reptile's neck, and inserting the snake by degrees into a box. It was always an uncivil, untamable animal, utterly indifferent to the comforts and allurements of civilized life. We contented ourselves with letting him alone and looking at him through the wire gauze front of his box. A large rattlesnake (*Crotalus durissus*) was sent us from the Blue Mountains, but it had been so long in captivity before reaching us that all the spirit was out of it. It had large fangs, but never showed any disposition to use them, and though we took it from its box a dozen times a day and handled it sometimes not over-delicately, still it never resented any of these liberties. Twenty-five years have since passed away, yet, when I now think of our temerity in this instance, it is never without a shudder. What I did then with impunity I would not now repeat for a million of money.—*Science News.*

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Correspondence.

A Telephone Twenty-eight Years Ago.

To the Editor of the Scientific American :

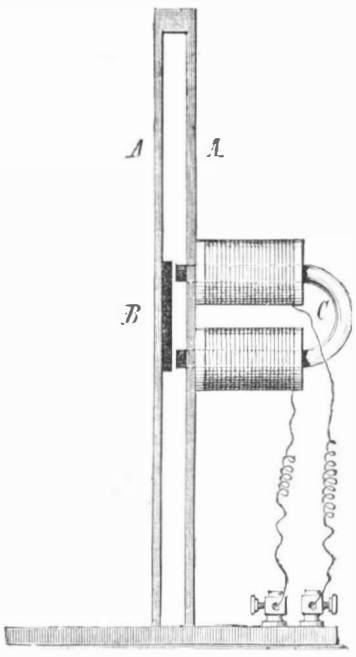
Will you allow me to call attention through your valuable paper to some early work relating to the telephone, which those who know of it regard as quite important in the history of this invention?

In the latter part of 1851, Mr. Edward Farrar, of Keene, N. H., quite recently mayor of that city, was occupying leisure moments in trying to transmit sounds over a telegraph wire, and actually succeeded in telegraphing music, and used a true telephone as a receiver!

His friends have been for some time desirous, in the interest of science, that his work should be more widely known, and in his own modest silence, I have obtained his permission to make the statement of it.

Some three years after his first actual telephonic success he had a correspondence with the Professors Silliman, of Yale College, with view of pursuing his work farther, but the replies he received were of such nature as to lead him to suppose that further attempt was hopeless, and under that impression and pressure of professional duties he laid it aside. I have before me some of that correspondence, and will quote from one of Mr. Farrar's letters a description of his experiment, and a statement which shows how closely he came to inventing a complete speaking telephone:

"Each reed of a melodeon is furnished with a small metallic point, which, while the reed is at rest, approaches near to the surface of mercury in a very small cup underneath the reed, into which the point dips when set in motion. The reeds are connected with one pole of a battery, and the cups



with the other. The current is broken with each vibration of the reed. At the remote end of the wire is a temporary magnet, with an armature fixed upon a spring in near proximity to the magnet, and which is affected as a reed at the other end of the line is set in motion."

What he here calls a "spring" will be seen by the figure to be a real telephone. It was made of two upright thin spruce boards, A A, to one of which was fixed the armature, B, and to the other the electro-magnet, C. The boards were seven or eight inches wide, about two feet long, and placed half an inch apart, and joined at the top by a strip glued between them.

He continues—"The effect is that the armature vibrates with the reed set in motion, and, the pitch of a sound depending on the rapidity of vibration, it will be the same in the reed and armature. A tune on the instrument will therefore produce a tune on the armature. What may appear somewhat strange, several different tones may be heard when chords are struck upon the instrument.

"The object of my inquiry was this. If the current power could be varied by some slight variation of a vibrator to be affected by the atmosphere as the tympanum of the ear is, the supposition is that the sounds of the voice might be reproduced by the means stated above(!)"

When it is remembered that Mr. Farrar penned the above in May, 1854, it is to be regretted that he was turned aside from so interesting an inquiry at so critical a point, and that he did not take that one step which would have then produced the speaking telephone.

We believe Reiss' telephone was made in 1861, ten years later than Mr. Farrar's. Can any earlier work than his be named?

S. H. BRACKETT,
Teacher of Natural Science, St. Johnsbury Academy,
St. Johnsbury, Vt.

The Fast Ice Boat.

To the Editor of the Scientific American :

Fifty-two or fifty-three years ago the past winter, Mr. Daniel Bray, then of Richmond, Ontario county, N. Y., a boy about 16 or 17 years of age, constructed an ice boat which was successful in all respects. It was used on Honeoye Lake, in that county, and is said to have run at the rate of a mile in a minute, when the ice was in good condition and the wind fair. It was built as follows: He used a light, flat bottomed boat for the body, to guard against accidents that might ensue from running into air holes. Underneath this and about one-third the distance from bow to stern, he placed a plank crosswise, about sixteen feet long, which he securely fastened to the boat, and to each end of this plank was fastened large flat bottomed skates, the inner edges being a little the highest. A heavy stout rudder was next attached, on the inner edge of which was also fastened a large skate, but this was creased in the center. Sails, same as now used for sailing on the water, were supplied, when our young voyager was ready to "fly with the wind." I have heard eye witnesses and those who have rode in it say it could be run faster than the wind blew. I also notice in your paper of a recent date, a cut of a velocipede sleigh, the exact counterpart of one made by Mr. Bray thirty years ago, and used by the writer when a boy. J. B. B.

Steamboat Smaller than the "Nina."

To the Editor of the Scientific American :

That "smallest steamboat in the world" is larger than one made and used years ago by S. H. Roper, of this city (inventor of the Roper Caloric Engine). Roper's boat was 14 feet long, 17 inches wide, 12 inches deep, made of ¼ inch cedar; and after going about the harbor and four miles to sea, as far as Nahant, he would take it on his shoulder and carry it home.

The boiler, of 1-20 inch steel, was 8 inches diameter, 18 inches high, vertical, 63 tubes, and carried 250 lbs. steam; cylinder, 1 inch diameter, 2 inch stroke; screw, 12 inches; speed, 8 to 10 miles per hour. The boat drew 2 inches of water without passengers. Screw set at an angle.

The engine was condensing, and one gallon of water was a supply for one day. A rotary gear pump fed the boiler, sometimes against 300 lbs. pressure. The same engine was used on a velocipede to travel about the streets upon. The condenser was a pipe, which formed the keel of the boat. The fuel used was wood, about 2½ bushels of maple for a day's trip. Smokestack, 5 feet high. G. B. G.

Boston, March 14, 1879.

The Circle not Squared.

To the Editor of the Scientific American :

Referring to your issue of April 19, Q. E. D. has not only not squared the circle, but he has shown that he does not even comprehend the problem. There is no difficulty in finding the area of a circle, and no difficulty in finding the side of a square of exactly the same area. The pith of the famous problem is to find by a regular geometrical construction a line whose square shall be equal to the area of the given circle. And this Q. E. D. has not done. Rolling a circle on a plane is no more a geometrical process than finding the circumference of the circle with a piece of tape.

New York, April 10, 1879. A. B. C.

ENGINEERING INVENTIONS.

An improved steam boiler having an annular water space and an inner cylindrical receptacle through which the flues pass, and having the inner and outer water spaces connected at intervals at the top and bottom, has been patented by Mr. William Hopkins, of Dubuque, Iowa.

Mr. George H. Cobb, of Palmer, Mass., has devised a novel automatic cut-off for steam engines, which consists in a sliding cam of peculiar shape, which rotates with the engine shaft and is moved by the governor. This in connection with the usual eccentric gives the required motion to the slide valve of the engine.

An improved gauge cock, capable of indicating the height of the water in the boiler through a wide range, has been patented by Mr. Joseph B. Leger, of Handsborough, Miss. The principal feature of the invention is a curved tube, which projects into the boiler, and may be turned up or down to the surface of the water. The discharge tube at the outside of the boiler projects in the same direction and for the same distance as the inner tube, and serves to indicate the height of the water.

Mr. Andrew Harvey, of Detroit, Mich., has patented an improved accessible joint, valve, and trap protector for underground pipes. The joint is made large enough to admit a person, and it is accessible by a manhole from the surface of the ground.

The Tables Turned.

It is not many years since the freightage of Atlantic steamers was almost wholly this way. We were importing heavily from Europe, and with the exception of cotton we sent little or nothing in return. In a recent letter to the London *Times*, Mr. David McIver, member of Parliament for Birkenhead, and one of the owners of the Cunard line of steamers, declares unhesitatingly that from his own experience as a carrier, he does not know of any nation whose trade prospects at present are so gloomy as those of Great Britain. The depression in the United States and elsewhere does not at all approach the depression there. The British exports to the United States are comparatively nothing, either as regards volume or value. The British food importations are steadily increasing, and the balance of trade is so overwhelmingly against Great Britain that he sees nothing except ruin in prospect for home industries, whether manufacturing or agricultural, if the present state of things is allowed to continue. The export trade from Liverpool to the United States is so small that whenever the restrictions on the importation of United States cattle are removed, gentlemen who are prepared to put additional steamers into the trade deliberately intend to make the outward voyages with water ballast only, without joining in the scramble for the little outward freight which other owners have been recently carrying as ballast at merely nominal rates.

PREMIUMS FOR BOYS.

The disposition of farmers' sons to escape from farm labor at the earliest possible moment is doubtless due less to the nature of the work than to the fact that farmers' boys are usually expected to work as a matter of course, and without any personal interest in the result. His efforts receive no special recognition or reward, and few opportunities are offered him for personal distinction or profit.

Mr. Stillman B. Allen, of York county, Maine, believes that much good might be done by taking more account of boys' labor on farms, and sets a practical example by offering a series of premiums to the boys of his county, for individual efforts in farming. Thus, to the boy (under sixteen) who shall raise the most Indian corn on one eighth of an acre of land during the coming season, he offers a premium of $100. To the boy who shall raise the next largest quantity, $50, and to the five boys who shall raise the next largest quantity, $10 each.

The conditions are easy, and the awards are to be made by the President of the County Agricultural Society. At the end of the season each contestant will have to make and sign a full report, giving the shape, description, and location of land, when planted, when and how many times hoed, when stalks were topped, if at all, when harvested, and how much is raised, and as nearly as can be estimated, the value of manure, and number of days' labor spent upon the crop, excluding the husking, when he may have all the help he wants from the boys and girls in the neighborhood.

The example set by Mr. Allen is worthy of being widely followed, not only for the immediate effect in heightening the interest of boys in farm work, but for its indirect effect in raising the standard of such labor. The boy that has learned by actual trial that it is possible, by careful cultivation, to get from an eighth of an acre as large a crop as the average farmer gets from twice or thrice the ground, will not soon forget the lesson.

Collection of Meteoric Specimens.

Mr. Charles B. Shepard, of New Haven, Conn., has accumulated, it is believed, the largest collection of meteoric stones in the United States, if not in the world. The collection embraces more than five hundred meteoric stones and meteoric irons. The total weight of the collection is about twelve hundred pounds. The largest iron, procured from Colorado, weighs 436 lbs., and the smallest, from Otsego county, N. Y., weighs half an ounce. The largest entire stone, procured from Muskingum county, Ohio, weighs fifty-six lbs., and the smallest one, from Sweden, weighs less than fifty grains. The specimens have been gathered from all parts of the world. The catalogue begins with one which fell November 7, 1492, in Alsace, and ends with one which fell February 12, 1875, in Iowa county, Iowa. There are none between 1492 and 1753, but most of the years since the latter date are represented and some years by several specimens. Nearly every country in the known world is represented in the list. The entire collection is in one of the buildings in Amherst College. Mr. Shepard makes one statement which will surprise most persons. He says: "There have been several instances of death occasioned by meteoric stones. Two monks in different places were thus killed in Italy, and two sailors on shipboard in Sweden."

Heinrich Wilhelm Dove.

Heinrich Wilhelm Dove, the celebrated meteorologist, died April 5. Professor Dove was born at Liegnitz, Prussian Silesia, October 6, 1803. He studied at Liegnitz, Breslau, and Berlin. In 1826 he became a teacher, and afterward a professor extraordinary in the University of Königsberg. In 1829 he was invited to a similar chair in Berlin. In 1837 he was admitted to the Academy of Sciences, and in 1845 became a full Professor of Physics. He distinguished himself by his researches in electricity and meteorology, and published various works upon these subjects. His reports and isothermal maps afforded the first representation of the isothermal lines of the whole globe for every month of the year. He was the first to announce the presence of a secondary electric current in a metallic wire at the moment that the circuit of the principal current is completed. He was Director of the Prussian Observatories, and made many useful reports. He began in 1837 the publication of "A Complete Repertory of the Physical Sciences," in which he was to be assisted by the most eminent men of science; but the progress of the work was interrupted. His book on the distribution of heat on the surface of the globe has been translated into English.

Diphtheria in Fowls.

A fatal disease prevailing among fowls at Marseilles is described by Nicati and Garard to be very like diphtheria. Thick false membranes of yellowish color covered sometimes the mouth and the pharynx, sometimes the eyes, in one case they were found reaching into the bronchi, and affecting the lung. One hen died the day after the first symptoms appeared, others in three and five days, while some remained ill for weeks. The hen so attacked utters a peculiar kind of cry, opening its beak with difficulty. Symptoms of a similar nature have still more recently been observed by M. Nicati in a pigeon house in Marseilles.

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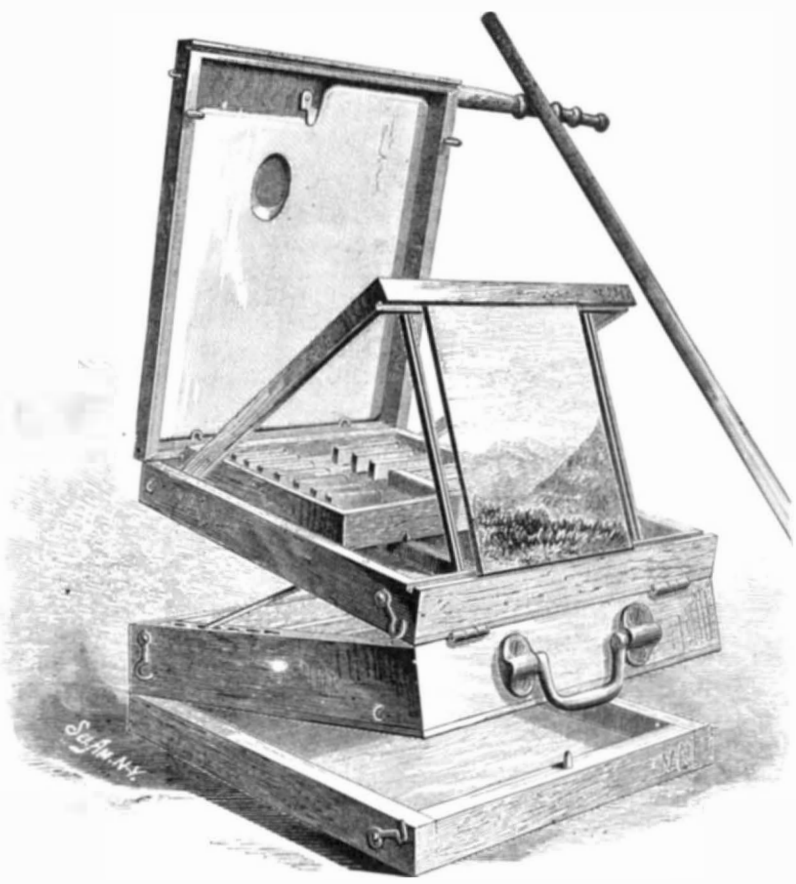
A CONVENIENT BOX FOR ARTISTS.

The accompanying engraving shows a novel and convenient box for artists' use, recently patented by Mr. William H. Brownell. of Brooklyn, N. Y. It answers the double purpose of a receptacle for palette, colors, and other tools and materials, and of an easel for supporting the board canvas or tile upon which the work is to be done.

The box, as will be seen by reference to the engraving, consists of four sections, hinged together alternately at opposite ends, and capable of closing compactly together so as to be readily carried by the handle.

When the box is opened for use it presents the appearance shown in the engraving. Everything contained in it is accessible, and it holds the board or tile firmly and in a convenient position. A pin is provided for holding the rest stick, and the whole affair seems well adapted to suit the needs of artists either in the field or studio.



ARTIST'S BOX.

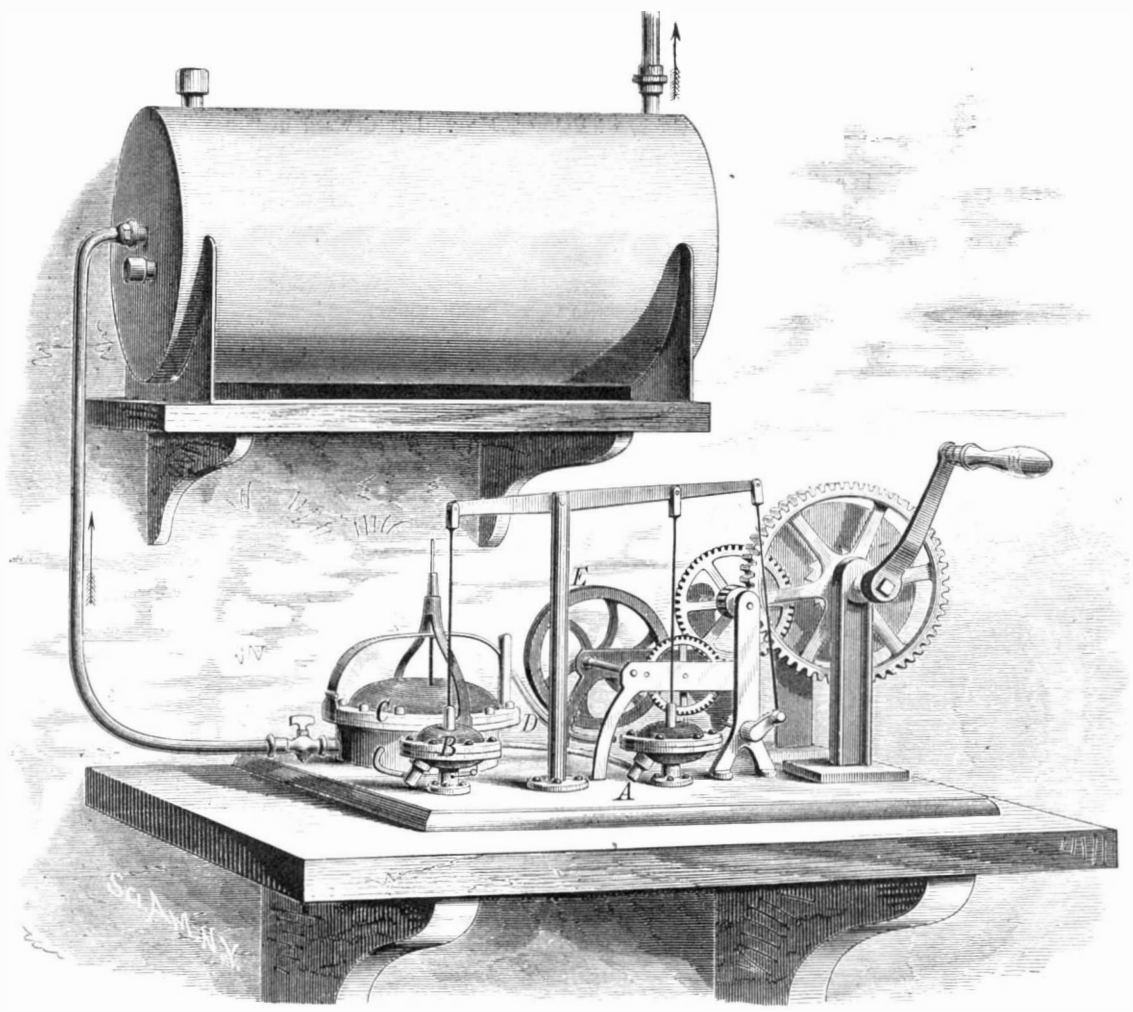
American Petroleum in Europe.

A dispatch received by the Department of State from Mr. James R. Weaver, United States Consul at Antwerp, calls attention to the serious and growing dissatisfaction now felt in Europe with regard to the quality of refined petroleum imported of late from this country, and expresses fears that unless some satisfactory explanation thereof be given, the government of Belgium will be called upon to restrict the importation of refined oil by the imposition of a heavy duty, or prohibit it altogether unless it comes up to a high fixed standard. Either of these regulations would be disastrous to the American petroleum trade. An expert sent to Europe by one of the largest of the American oil refining companies to investigate the complaints says that the difficulty does not arise from imperfect refinement of the oil, but from the fact that the oil now obtained, particularly in the Bradford district, differs materially in its characteristics from that heretofore exported, especially in specific gravity, and requires different wicks and burners. He affirms that the oil now produced is no more liable to explosion than the earlier quality, and that it cannot be improved by more thorough refinement without great additional cost. The whole question is about to receive special attention at Bremen, where a general assembly of delegates from various parts of Europe will shortly be convened to consider the complaints and difficulties, and decide upon such remedies as the circumstances demand. Mr. Weaver warns American refiners and exporters that unless they take some steps to remove the present dissatisfaction, there is great danger that they will lose a large part of their present European trade.

A NEW CARBURETER.

The problem of economical artificial illumination has of late received more than ordinary attention; but the entire effort seems to have been in the direction of electrical lighting; quite recently, however, an apparatus has been patented which looks toward the solution of the problem in another way. We refer to Messrs. Pew & Wearts' carbureter, shown in the accompanying engraving.

This machine, which the inventor calls the "Eclectic Gas Machine," is designed to produce an illuminating gas from a light hydrocarbon by the admixture of a suitable quantity of common air, or it may be used to enrich the ordinary illuminating gas. The machine is quite simple in its construction, although the few wheels shown give it the appearance of complication. There is, however, nothing fine or intricate about the gearing; it is driven by a weight, and its sole office is to work two small diaphragm air pumps, A, B, through the medium of the crank, connecting rods, and working beam. These pumps force air through the regulator, C, into the large reservoir above. When the maximum pressure is reached the raising of the flexible diaphragm in the regulator carries upward the brake lever, D, bringing a brake against the fly wheel, E, and stopping the action of the pumps. When the pressure diminishes, the brake falls away, and the mechanism is permitted to operate again. The reservoir is divided by hollow perforated or wire gauze partitions, the outer spaces of which are filled with a fibrous or porous material that absorbs the hydrocarbon and delivers it to the air as it passes through. By means of this arrangement a large surface of hydrocarbon is exposed to the air passing through the apparatus without the necessity of keeping in the reservoir a large quantity of the liquid. It is stated that this apparatus effects a saving of over eighty per cent in the expense of lighting.



PEW & WEARTS' CARBURETER.

Messrs. Pew & Wearts inform us that at a recent test in the Western Union Telegraph Office, Philadelphia, the gas meter registered one foot per hour for each burner, instead of the usual six feet, or only six hundred and twenty-five feet, during five tests of five hours each, as compared with seven hundred and fifty feet, the amount usually consumed.

This system is covered by three United States patents, issued since the first of the year to Mr. Pew.

For further information address Messrs. Pew & Wearts, 239 Broadway, New York.

Neglect of Rest a Cause of Drunkenness.

In the opinion of Dr. Jackson, "the refusal to take proper physical rest, when tired from labor, is one of the most important and powerful in inducing a love for and an indulgence in the use of ardent spirits. Men work till they get so tired that they cannot wait to feel sensibly rested by processes of change going on in their systems from suspension of labor. They either want to work more hours than they are able to do; or when they have done as much as they feel themselves at liberty to do, they are so tired that they cannot rest. They get rest, therefore, in artificial ways, by resorting to eating and drinking. Some get rested by drinking tea, others by drinking coffee, others by chewing and smoking tobacco; but the great majority of tired people in this country—and the larger share of our people are tired—drink ardent spirits in some or other of its forms or preparations. They fall back on stimulants instead of the intrinsic vitalities of their bodies. They therefore are lifted up into false conditions. Accepting these as true, they keep on working till they become so functionally impaired as to induce positive inability to work longer, or they become so constitutionally depreciated as to be smitten with incurable disease."

There can be no doubt that the neglect of physical rest is, as Dr. Jackson asserts, the occasion of much over-frequent resorting to alcoholic or other stimulants; but it is not by any means apparent that too long-continued work is the only or the main cause of the deficient rest which results so disastrously. Whether workers or not, those who stimulate too much do so not because they have no opportunity to rest, but because they spend in dissipation the hours they should and could devote to sleep.

The Balloon Expedition to the Pole.

The veteran aeronaut, Prof. John Wise, has removed his residence from Lancaster, Pa., to Louisiana, Mo., and he communicates to the *Kansas City Times* the following letter regarding Commander Cheyne's plan for reaching the North Pole by the use of balloons. The venerable Professor says: Nothing could give me more pleasure than to be one of the explorers. I have such a confirmed belief in the habitableness of the Polar archipelago, and of its uniqueness as to climatic and comfortable conditions, that I believe no one would want to get out of it that ever got into it.

We know that it is surrounded by an ice wall that is insurmountable by all ordinary means of land and water vehicle, and hence the air ship will be the successful craft. Beyond the eighty-second parallel no human foot has yet trodden, unless it was Kane, in whose time the world was not yet oblated so much as to present the condition of a basin that receives the sunbeams in half the year against its glacial sides. The earth of necessity is becoming more oblated all the time, if there is any truth in the law of motion as we comprehend it, and whatever theory we may adopt as to its original formation, whether by slow nebular accretion or by sudden condensation of cometary matter, it is a plastic body, and does conform itself to the law of centrifugal and centripetal conformation.

An electrical mystery surrounds the North Pole region, something in the nature of the coil magnet, from which such amazing developments proceed in the mode of light and electric magnet machinery that draws the attention of the scientific master minds of the day.

For over a hundred years the most daring and persevering efforts have been made to enter this basin. That it must be an archipelago, the shape of the earth and its motion, in connection with the equatorial heat in air and water, do strongly attest; and that it must be a delightful country, the circumstances of its existence verify. It cannot be very cold in the long winter night, as there must be a humid atmosphere pervading it from the pouring in of the equatorial heated submarine gulf streams. Nature is sufficient for all

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and any necessity to the existence of animals, and what of it is human's should be disposed of by hibernation for three or four months in the year. Why, Mr. Editor, it does me good just to think of the thing, and to go into it would more than rejuvenate me for another three-score and eleven.

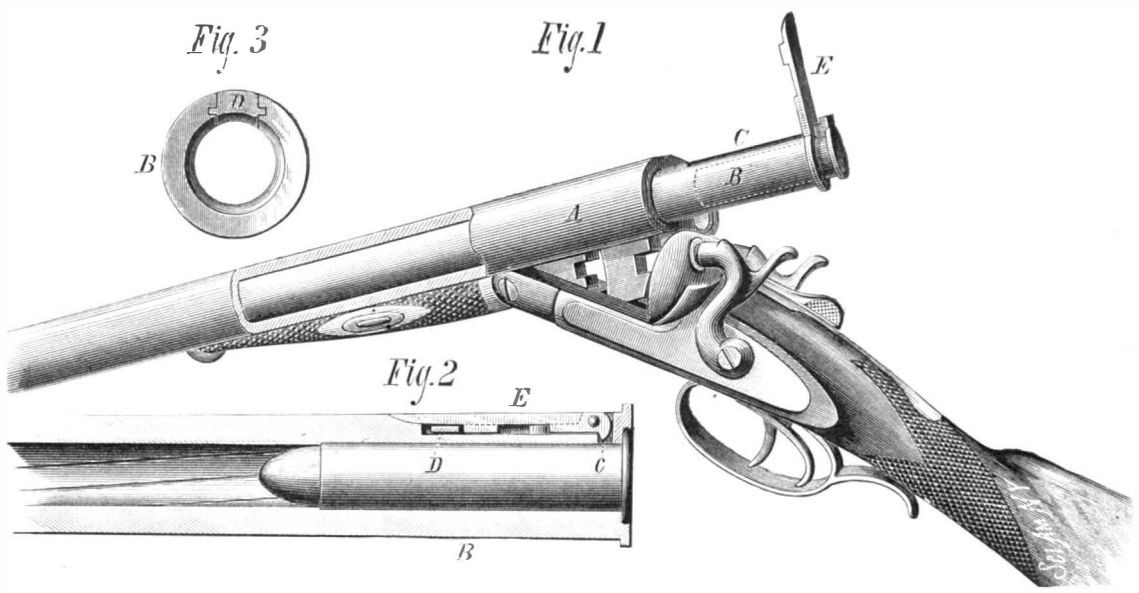
JOHN WISE.

Elm Cove Cottage, near Louisiana, Mo., April 2, 1879.

IMPROVED BARREL FOR BREECH-LOADING SHOT GUNS.

The accompanying engraving represents an improvement in rifle barrels for breech-loading shot guns, recently patented by Mr. Joshua Stevens, of Chicopee Falls, Mass., Fig. 1 being a perspective view showing the gun and attachment; Fig. 2 shows the breech of the rifle barrel; and Fig. 3, a longitudinal section of the same.

The rifle barrel, B, is fitted to the shot gun barrel, A, and provided with a longitudinal recess for receiving the slide, D, in which is pivoted a lever, E, having at its rear end a short projection, *c*, extending inward. The rifle barrel, B, is inserted into the rear end of the barrel of an ordinary breech-loading shot gun, the flange formed on the end of it entering the recess made in the shot gun barrel for the reception of the cartridge flange. The cartridge is now inserted and the gun is used in the ordinary way. After the discharge the barrel of the gun is tilted down, and the extractor starts the rifle barrel out of the shot gun barrel; this operation moves the slide, D, slightly and starts the cartridge shell. Should this prove insufficient the rifle barrel is drawn out far enough to admit of raising the lever, E, which operation moves the slide, D, and ejects the shell. An attachment of this kind must prove a valuable acquisition for the sportsman.



STEVENS' RIFLE BARREL FOR BREECH-LOADING SHOT GUNS.

THE GREAT CRAB-SPIDER.

The great crab-spider belongs to the typical genus of this family, and is one of the formidable Arachnida that are said to prey upon young birds and other small vertebrates, instead of limiting themselves to the insects and similar beings which constitute the food of the generality of the spider race. All spiders are carnivorous, the dimensions of their prey varying with those of the destroyer, and it is by no means an illogical supposition that a spider whose spread of limb equals that of a human hand, might suck the juices of some of the smaller and more helpless vertebrates.

In Madame Merian's well known work on the insects of Surinam, there is a careful and forcible sketch of one of these great spiders (*Mygale avicularia*) engaged in preying upon a humming-bird, which it seems to have taken out of its nest. She gives also a description of this spider, mentioning that it chiefly feeds upon ants, but that when they fail, it climbs the trees and catches the humming birds. For a time this account was believed, and the spider received the specific name of *avicularia* in consequence of its bird-catching propensities. After a while, however, several persons ventured to discredit the story, and at last both the account and the illustration were set down as simple fabrications of the imagination. Experiments were also tried, dead humming-birds being put into the dens of these spiders, without any result, and the whole of Madame Merian's account was bodily denounced as fabulous.

Lately, however, the *Mygale* has been seen repeatedly to kill the young, not only of the humming-bird, but of other vertebrates, and thus Madame Merian's reputation for veracity remains intact.

The *Mygale* spins no web to serve it as a dwelling. It burrows and lies in ambush in the clefts of hollow ravines, in volcanic tufas, or in decomposed lava. It often travels to a considerable distance, and conceals itself under leaves to surprise its prey, or it climbs on the branches of trees to surprise the colibris (*i. e.*, humming birds) and the *certhia flaveola* (a bird allied to our common tree creeper). It usually takes advantage of the night to attack enemies, and it is commonly on its return toward its burrows that one may meet it in the morning and catch it, when the dew, with which the plants are charged. slackens its walk.

The muscular force of the *Mygale* is very great, and it is particularly difficult to make it let go the objects which it has seized, even when their surface affords no purchase, either to the hooks with which its tarsi are armed, or to the claws which it employs to kill the birds and the anolis (a kind of tree lizard). The obstinacy and bitterness which it exhibits in combat cease only with its life. Some, pierced twenty times in the corselet, continued to assail their adversaries without showing a desire to escape.—*Wood's Natural History.*

CRAB-SPIDER, OR MATOUTOU.

The Peanut Crop.

The following facts gathered by a Virginia peanut dealer, and submitted by him to the *Commercial Bulletin*, show the peanut crop to be of much greater importance than most people imagine. During the past five years the Virginia crop has ranged between 225,000 bushels and 780,000 bushels. The lowest crop of Tennessee was 175,000 bushels; the highest, 305,000 bushels. Of North Carolina, the lowest crop was 60,000 bushels; the highest, 125,000 bushels. The largest crop of the whole country was that of 1876–77, amounting to 1,405,000 bushels. The estimated crop of the coming season is 1,290,000 bushels. The Virginia nuts are the largest and have the finest flavor.

The grades of the Virginia nuts are, respectively, common, prime, strictly prime or choice, and fancy. The prices for nuts during the present season, on a basis of prime to strictly prime, have ranged as follows: October 7, first sale, new crop, at $1.25; and during the rest of the month at $1.20 to $1.10. November—Sales during month at $1.05, $1, 85 and 80 cents. December—80 and 85 cents. January—75, 80, and 85 cents. February—85 and 80 cents. March—80, 82½, 85, 90, 92½, and 95 cents.

Important and Excellent Appointments.

The appointment of Clarence King to the Directorship of the Consolidated National Surveys was confirmed by the Senate April 3. The same day the Senate confirmed the appointment of Dr. John B. Hamilton as Surgeon-General of the Marine Hospital Service.

A few days earlier Professor Francis A. Walker was appointed Superintendent of the coming Census.

It is doubtful if these offices could have been otherwise filled so wisely and acceptably.

Unconsidered Uses of Wood.

The London *Timber Trades Journal* notes that there are countless ways in which wood is being consumed, besides the larger uses for fuel, building purposes, and the like; and that in the aggregate these unconsidered uses amount to a serious drain upon the forests, while little or nothing is done to insure a supply for future demands. The enumeration of the special uses of wood in the arts forms a very interesting chapter. One of the principal uses of the wood of the holly, dyed black, is to be substituted for ebony in the handles of metal teapots, etc., and the strong straight shoals, deprived of their bark, are made into whip handles and walking sticks. The lime tree forms the best planks for shoemakers and glovers upon which to cut their leather, and is extensively used in themanufacture of toys and Tunbridge ware, and by the turner for pill boxes, etc.; and the inner bark is made into ropes and matting. The sycamore furnishes wood for cheese and cider presses, mangles, etc.; and when the wooden dishes and spoons were in common use they were mostly made of this wood. It is used now also in printing and bleaching works, for beetling beams, and in cast iron foundries for making patterns. The yew is used by the turner and made into vases, snuff-boxes, and musical instruments; and it is a common saying among the inhabitants of New Forest that a post of yew will outlast a post of iron. Where it is found in sufficient quantities to be employed for works underground, such as water pipes, pumps, etc., the yew will last longer than any other wood. Gate posts and stakes of yew are admirable to wear, and in France the wood makes the strongest of all wooden axletrees. Of the beech are made planes, screws, wooden shovels; and common fowling pieces and muskets are also stocked with it, and beech staves for herring barrels are not unknown. The sweet or Spanish chestnut furnishes gate and other posts, railing, and barrel staves, hop poles, and other such matters, such as strong and good charcoal, though scarcely equal to that of oak for domestic purposes, but considered superior to that of any other for forges.

Hornbeam is the best wood that can be used for cogs of wheels, excelling either the crab or the yew; but its application in this manner is about at an end. As a fuel it stands in the highest rank, emitting much heat, burning long, and with a bright clear flame. In charcoal it is highly prized, not only for culinary purposes and the forge, but also for the manufacture of gunpowder, into which, on the Continent, it enters in large proportion.

In Russia, many of the roads are formed of the trunks of the Scotch pine, trees from six inches to a foot in diameter at the larger end being selected for the purpose. These are laid down side by side across the intended road, the thick of one alternately with the narrow end of the other,and the branches being left at the end to form a sort of hedge on each side of the road. When thus laid, the hollows are filled up with earth, and the road is finished, being analogous to the corduroy roads of North America. In Germany casks are made of larch, which is almost indestructible, and they allow of no evaporation of the spirituous particles of the wine contained in them. In Switzerland it is much used for vine props, which are never taken up, and which see crop after crop of vines spring up, bear their fruit, and perish at their feet without showing symptoms of decay. The uninjured state in which it remains when buried in the earth or immersed in water renders it an excellent material for water pipes, to which purpose it is largely applied in many parts of France. The butternut is esteemed for the posts and rails of rural fences in America, for troughs for the use of cattle, for corn shovels and wooden dishes. Shellbark hickory provides baskets, whip handles, and the backbows of Windsor chairs. The pignut hickory is preferred to any other for axletrees and ax handles. The sugar maple is used by wheelwrights for axletrees and spokes, and for lining the runners of common sleds. Dogwood is used for the handles of light tools, such as mallets, small vises, etc. In the country it furnishes harrow teeth to the American farmer, and supplies the harness of horses' collars, etc.; also lining for the runners of sledges. The mountain laurel

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is selected for the handles of light tools, for small screws, boxes, etc. It most resembles boxwood, and is most proper to supply its place. Bowls and trays are made of red birch, and when saplings of hickory or white oak are not to be found, hoops, particularly those of rice casks, are made of the young stocks and of branches not exceeding one inch in diameter. Its twigs are exclusively chosen for the brooms with which the streets and courtyards are swept. The twigs of the other species of birch, being less supple and more brittle, are not proper for this use. Shoe lasts are made from birch, but they are less esteemed than those of beech. Immense quantities of wooden shoes are made in France from the wood of the common European alder, which are seasoned by fire before they are sold. The wood of the locust is substituted for box by the turners in many species of light work, such as saltcellars, sugar bowls, candlesticks, spoons, and forks for salads, boxes, and many other trifling objects, which are carefully wrought into pleasant shapes and sold at low prices. The olive is used to form light ornamental articles, such as dressing cases, tobacco boxes, etc. The wood of the roots, which is more agreeably marbled, is preferred, and for inlaying it is invaluable. Of persimmon turners make large screws, and tinmen mallets. Also shoemakers' lasts are made of it equal to beech, and for the shaft of chaises it has been found preferable to ash, and to every species of wood except lancewood. The common European elm is used for the carriages of cannon, and for the gunwale, the blocks, etc., of ships. It is everywhere preferred by wheelwrights, for the naves and fellies of wheels, and for other objects. White cedar serves many subsidiary purposes. From it are fabricated pails, washtubs, and churns of different forms. The ware is cheap, light, and neatly made, and instead of becoming dull, like that of other wood, it grows whiter and smoother by use. The hoops are made of young cedars stripped of the bark and split into two parts. The wood also supplies good charcoal. The red cedar furnishes staves, stopcocks, stakes, and is also used for coffins.

A few special applications of wood in this country are mentioned, separated into trades, namely:

Sieves, usually of black or water ash for the bottom and oak or hickory for the circle; whipstocks, white oak; baskets, willow, white oak, and shellbark hickory; picture frames, white pine and sweet gum; saddletrees, red maple and sugar maple; screws of bookbinders' presses, hickory and dogwood; hatters' blocks, sour gum; corn shovels, butternut; shoe lasts, beech, and black or yellow birch.

To attempt any comprehensive review of the list of American applications would require another column or more.

Reports on the Paris Exhibition.

Governor McCormick, Commissioner General to the Paris Exhibition, requested the Assistant Commissioners to complete and forward to him their reports by the 1st of April. The following is a list of these reports:

Governor R. C. McCormick, Commissioner-General: "The Administrative Bureaus of the American Representation at the Paris Exhibition of 1878."

F. A. P Barnard, of New York, President of Columbia College, Assistant Commissioner-General: "The Exhibition at Large and the General Results thereof."

Daniel J Morrell, of Pennsylvania, President of the Cambria Iron Works and President of the American Iron and Steel Association: "Iron and Steel."

Donald G. Mitchell (Ike Marvel), of Connecticut: "Household Furniture and Accessories."

William W. Story, of Massachusetts: "Art."

Henry Howard, of Rhode Island: "Textile Fabrics."

William T. Porter, of Delaware, artisan expert: "Machinery."

Thomas B. Furguson, of Maryland, Commissioner of Fish and Fisheries: "Fish and Fisheries."

William A. Anderson, of Virginia, of the Tredgar Iron Works: "Transportation."

George W. Campbell, of Ohio, grape grower: "Horticulture."

John J. Woodman, of Michigan, President of the Michigan Grangers' Association, and practical farmer: "Grains."

A. J. Sweeny, of West Virginia, Mayor of Wheeling, artisan expert: "The Latest Devices in Machinery."

Samuel Dyshart, of Illinois, stock raiser: "Live Stock."

Thomas E. Jenkins, of Kentucky, Professor of Chemistry: "Chemicals."

Floyd B. Baker, of Kansas, Editor of the *Topeka Commonwealth:* "Forestry."

James D. Hague, of California, mining engineer: "Mines and Mining."

Pierce M. B. Young, of Georgia, planter: "Cotton."

Aristides Gerard, of Louisiana, inventor: "Steam Engines."

Joshua Q. Chamberlain, of Maine, President of Bowdoin College, and ex-Governor of Maine: "Education."

Eliot C. Jewett, of Missouri, mining engineer: "Technical Schools."

The following named reports have been requested from Honorary Commissioners appointed by the President on the nomination of the Governors of States:

William P. Blake, of Connecticut, Editor of the Reports of the Representation of the United States at the Paris Exhibition of 1867, Commissioner of the United States at the Vienna Exposition in 1873, and Commissioner to the Centennial Exposition at Philadelphia: "Ceramics."

Edward H. Knight, of the District of Columbia, Editor of the "Mechanical Dictionary:" "Agricultural Implements."

The reports are carefully collated and indexed by the Commissioner General and will be delivered to the Government by May 1. They will fill four volumes royal octavo, uniform with the reports on the Paris Exhibition of 1867 and Vienna of 1873.

It is to be hoped that the printing of these reports will not be long delayed. The industrial world moves rapidly, and such reports soon become practically antiquated.

The Commissioner-General has learned from the Director-General of the Exhibition that in spite of delays in the execution of the medals, he may expect the medals at an early date. As soon as received they will be forwarded to those to whom they were awarded.

The Commissioner-General expects to close up the affairs of his office by July 1. It appears that there will be a handsome sum to the credit of the Government out of the $190,000 appropriated for a proper representation of the United States at Paris.

GRAY POTTERY.

The composition of that class of potter's ware designated as "gray" pottery was known thousands of years ago to the Chinese and Japanese. At the Louvre, in Paris, there is

GERMAN GRAY POTTERY.

to be seen a large vase of Japanese origin, several feet high, and of great beauty. In Europe gray pottery was first manufactured in Germany, in the provinces of Saxony, Bohemia, and Silesia, at the beginning of the Renaissance Period. Later, Boettcher manufactured gray pottery at Meissen, previous to discovering the art of making porcelain.

Our engraving represents a vessel, probably used to hold water or wine, of Silesian origin. It shows elaborate ornaments of different colors, in relief, on a sky-blue ground. It is now at the Louvre Museum, and illustrates well the artistic taste of that period.

NEW AGRICULTURAL INVENTIONS.

An improved seed planter, having a rotating hopper, which rolls on the ground, and in which there are a number of seed pockets, which deposit seed in a furrow formed by a plow or furrow opener, has been patented by Mr. William J. Ellis, of Oakland, Ga.

Mr. John Clayton, of the Grange Farm, Clayton (Brainerd P. O.), Minn., has invented an improvement in gang plows, the object of which is to regulate the width of the cut or furrow of the plow, so as to suit the power of the different teams that may be used, and to accommodate it to soil in which it is used. The plow is also provided with an adjustment for varying the depth of the furrow.

An improved rotary plow colter, which is provided with means for excluding dust and dirt from its bearing, has been patented by Mr. John Clayton, of Brainerd, Minn.

An improved cutter for plows, which is designed to shield the mould board, and lessen the wear of the plow, has been patented by Mr. Charles W. Twigg, of Fincastle, Ind. It consists of a cutter applied at the junction of the land side and mould board and extending to the beam.

Mr. Patrick Groom, of St. Louis, Mo., has patented an improved handle socket for shovels, spades, and scoops, which consists in making the shovel strap separate from the shovel blade, and securing it by rivets in a countersink formed in the blade.

A novel churn, that agitates and aerates the cream by centrifugal force, has been patented by Messrs E. B Older and F. E. R. Megow, of Independence, Iowa. This invention consists in a concave rotary dasher and a corrugated gatherer rotated by the dasher shaft.

A hay rack and fence, which is constructed so that the fence may be supplied with additional bars or rails, to convert a portion of the panels into feeding racks for cattle, has been patented by Mr. Louis Prince, of Nashville, O.

The Fate of a Herd of Buffaloes.

An army officer who recently arrived in Chicago from the Yellowstone Valley, tells a story of what happened to a herd of buffaloes as they were migrating southward. The herd numbered 2,500 head, and had been driven out of the Milk River country by the Indian hunters belonging to Sitting Bull's band. When they reached the river they ventured upon the ice with their customary confidence, coming upon it with a solid front, and beginning the crossing with closed ranks. The stream at this point was very deep. When the front file, which was stretched out a quarter of a mile in length, had nearly gained the opposite shore, the ice suddenly gave way under them. Some trappers who were eyewitnesses of the scene said it seemed as if a trench had been opened in the ice the whole length of the column. Some four or five hundred animals tumbled into the opening all in a heap. Others fell in on top of them and sank out of sight in a twinkling. By this time the rotten ice was breaking under the still advancing herd. The trappers say that in less than a minute the whole body of buffaloes had been precipitated into the river. They were wedged in so thickly that they could do nothing but struggle for a second and then disappear beneath the cakes of ice of the swift current. Not a beast in all that mighty herd tried to escape, but in a solid phalanx they marched to their fatal bath in the "Big Muddy." In a minute from the time the first ice broke not a buffalo's head or tail was to be seen.

Possibly occurrences of this sort, in ancient tertiary times, helped to form the remarkable deposits of bones found in the old lake beds of the great West and elsewhere. In these deposits the earth is literally crowded with the bones, sometimes chiefly of one type, sometimes comprising many distinct species. In the latter case the victims were probably swept away by sudden floods, their remains mingling confusedly in quiet basins.

The Textile Industries of Finland.

It is reported by the German press that a large amount of spinning and weaving machinery is being transferred to Russia from German mills, closed on account of declining trade. The Grand Duchy of Finland is becoming one of the principal seats of Russian textile manufactures.

There are five large cotton mills at Tammerfors, Abo, Nikolaistad, Forssa, and Kiroskoski. The imports of raw cotton have nearly trebled since 1866. The spinning mill of Forssa has 18,000 spindles and 500 looms, and employs 1,500 hands. The mill at Abo manufactures thread only, and Kiroskoski only textiles. Mostly all the domestic weaving of linens has been superseded by the great linen mill of Tammerfors, the only one in the country. It has five turbines, and employs about 900 hands. There are six manufactories of cloth, one of knit goods, and five mills for the manufacture of woolen yarns and textiles. The largest woolen cloth factory is near Abo, and turns out about 65,000 or 70,000 yards of cloth. The proximity of the Southern provinces to cotton supplies from Egypt will, of course, give them an advantage over such distant provinces as Finland.

Curiosities of Bismarck's Brains

In Dr. Busch's "Book on Bismarck," the Prince describes a horse accident he once had when riding home with his brother. He fell violently on his head. "I lost consciousness," he says, "and when I recovered it I had only half. That is, one part of my intellect was clear and good, the other half had gone." Finding (on examination) his saddle broken, he called for his groom's horse and rode home. When the dogs there barked, by way of salutation, he thought them strange dogs, and scolded them angrily as such. Then he said the groom had fallen with the horse, and they should go and fetch him, and he became angry when they would not do that (because of a sign from his brother). He seemed to be himself and at the same time the groom. After eating and sleeping he was all right next morning. He points out that he had done all that was necessary in a practical respect; herein the fall had caused no confusion of ideas. "In short, it was a remarkable illustration of the fact that the brain lodges different mental powers; but one of these had been stupefied for some longer period of time by the overthrow."

THE AFRICAN CABLE.—The steamer Kangaroo, with part of the cable to be laid between Natal and Aden, left the Thames April 7 for Natal via the Suez Canal. The Natal and Zanzibar section will be open for business in July. This will place South Africa within a week's communication of London. The remainder of the line will be completed before the end of the present year.

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OLD HOMES MADE NEW.

It is sometimes very desirable that an old house should be made over. But very often such remodeling costs as much as an entirely new structure; sometimes it costs more. The reason of this is doubtless that the alterations are made without sufficient forethought; they are made as they suggest themselves one after another. And when all is done it is an old house after all; the alterations do not seem worth what has been expended to effect them, and the owner is disgusted. More careful planning would have prevented mistakes, produced better results, and lessened the cost.

We have before us a book* designed to aid any who wish to make an old home into a new, which, as it helps to disseminate true ideas, is welcome. By the courtesy of the publishers we present the illustrations of the present article.

The author of this book says very justly that whether a dwelling should be remodeled or not is often an open question. It should not be done unless the building, in its construction and material, is of such a solid and substantial character as to render its destruction unadvisable; or unless its preservation is highly desirable, owing to family associations, its peculiar style of architecture, or some historical interest. The convenience of the plan, its adaptation to the individual wants of those who are to occupy the house, should be the paramount consideration. Let the exterior grow naturally from the plan. Let architectural effect be obtained by the natural combinations of the constructive portions of the work. Let the most effective result possible be secured at the least expenditure of labor and detail in design.

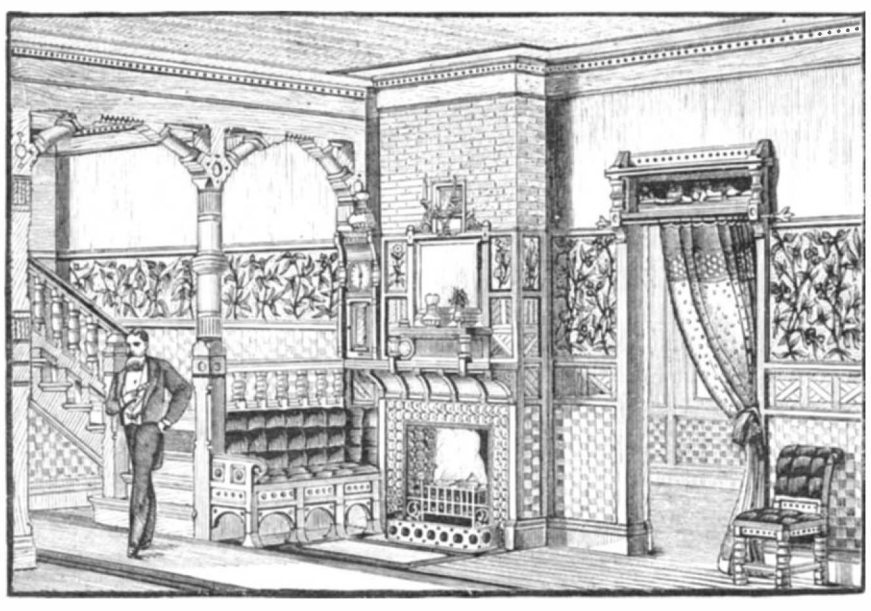
In our judgment the author has been generally very successful in these projected alterations. The illustration we present is, perhaps, one of the least striking, and yet any one can see in a moment by comparing these houses how much good taste can do in making a moderate outlay of money produce excellent results.

VIEW BEFORE ALTERATION.

VIEW AFTER ALTERATION.

The house in question was, as is seen, simply a commonplace building. It was in excellent condition as regards its materials, and large, airy rooms with open fireplaces, and a generous hall. The wish was to improve its appearance without destroying the date and character of the building. A veranda was added on one side; a projection on the first floor gave a bay window, continued in square form above, and breaking the roof with a gable. Portions of the end gables were made to project, forming canopies over balconies from the attic floor. A new porch was added on the front, and new sashes with one light of glass were introduced in the lower part of the windows. These simple, inexpensive changes interfered but little with existing work. The other illustration is of a remodeled hall. In the original house the stairway was narrow and inclosed. The desire was to make a hall that should be an attractive apartment, as well as a passage way. The old staircase was removed and a new one in hard wood built. A fireplace and settle were introduced at the foot of the stairs. The upper portion of the fireplace has the brickwork exposed, while the lower portion is incased for mirrors, etc. Curtains are substituted for doors. The end of the main hallway is marked and divided from the staircase by a newel column, finished with brackets. The whole makes a picturesque and comfortable apartment, a vast improvement on the "entry," which is really all that our halls usually are.

We need add only that the book is useful as a suggestion for plans and designs for building new as well as remodeling old houses.



A REMODELED HALL.

A Possible Cause of Unexplained Fires.

In a discussion of obscure causes of spontaneous combustion, by the French Academy of Sciences, a short time since, M. Cosson said that only a few days before, while he was at work in his laboratory, a portion of the boarding of the floor took fire. The fire began in the vicinity of an air-hole, fed with warm air from a stove four meters away, on the floor below. A similar accident took place two years ago, and in consequence M. Cosson had the boards adjoining the air-hole replaced by a slab of marble. The boards which now ignited adjoined the marble. The heat to which the boards were subjected was, however, very moderate, being only that of warm air at 77° Fah. Nevertheless, M. Cosson said the wood had undoubtedly been slowly carbonized. Being thus rendered extremely porous, a rapid absorption of the atmosphere had resulted, and sufficient caloric was thereupon produced to originate combustion. The danger thus disclosed, said M. Cosson, is one to which the attention of builders ought to be directed. In the instance in question, M. Cosson was able to extinguish the fire with a little water, as he was present and witnessed its beginning; but had it occurred at night, during his absence, it would undoubtedly have completed its work of destruction. M. Faye stated that at Passy, a few days before, a similar case of spontaneous fire, due to the action of the warmth from the air-hole of a stove upon the woodwork, had occurred at the house of one of his friends.

M. Dumas gave several analogous illustrations, and attributed the occurrence to the property of matter in an extremely divided condition, of energetically absorbing air with the generation of heat. In powder factories the pulverized charcoal will often take fire spontaneously. It is for this reason that it is usually pulverized with sulphur, which robs it of the property in question. Wood deprived of its moisture by the action of warmth, continued for a long time, is transformed into a substance analogous to lignite of turf. Its particles experience a species of pulverization, or minute division, which brings it into essentially the same condition as that of crushed charcoal. In this state it condenses the air and takes fire. M. Dumas said that he had known a case where a beam in a cart shed had taken fire in this way. Formerly, in the theaters, the lamp boxes, filled with refuse, frequently ignited spontaneously in this manner. The oily dust and *débris* condensed the oxygen of the air. In works where Adrianople red is applied to cotton, impregnated with fatty matter, spontaneous combustion frequently occurs. M. Dumas also cited a singular occurrence in the studio of a painter, which he had witnessed. The artist had taken some cotton wool to wipe a picture. He rubbed the oily surface of the painting for some time with the porous material, and then flung it from him; the cotton spontaneously ignited during its passage through the air. It is well to remember, concluded M. Dumas, that extremely porous or minutely divided matter, conducting air, is capable of instantly producing a very elevated temperature.

* "Old Homes Made New." With Explanatory Text. By William M. Woollett. New York: A J Bicknell & Co.

English versus American Castings.

A writer in the *Engineer* (London) endeavors to account for the success of American ironware in its competition with the home products of England. This competition, the writer says, is to be found in every ironmonger's shop in town and country, and particularly in furnishing ironmongery stores. "If we ask for locks, gas standards, roller-blind fittings, small brackets, hooks, and hat pegs, domestic apparatus and tools, substantial toys, and very many other things, we are shown American productions. The reason for this is not sufficiently obvious in all cases, though in many cheapness is the explanation. Hardly any English small castings are anything like as fine in surface, light in pattern, and cleanly turned out as are these American things. Small English castings often show the joint in the mould in which they are cast, fins are often not absent; and they are either turned out uncoated, or are daubed with a common black or dipped into a commoner. Most often screw holes are too large or too small. All this the Americans have changed. Their castings are light, though strong in design, they are clean, and are touched up on an emery or grindstone, and are nicely coated with a clear, brown varnish of great toughness and strength. The holes are almost invariably properly prepared to receive the screws for fixing. The screws themselves are colored to match the ironwork, and, at the same time, prevent rusting. The holes, too, are arranged so that where the greatest strain comes there are the most screws. Now, these are reasons which affect the purchaser only; but there are other reasons which affect the ironmonger, and which explain why he is so ready to show his customer the American articles. All the small articles to which we have referred are sent out by the English manufacturer done up in separate papers, or in paper packets tied up with string. Thus, when the ironmonger wants even one article, or only wants to show one to a customer, he has to undo a string, unfold paper or papers, do these papers up again, tie them, and rearrange the label on the package. Instead of this old bungling way of keeping store and serving customers, the Americans supply their articles in paper boxes, sufficiently strong to last out the sale of the articles one or two at a time. These boxes are easily and neatly stacked, the labels are fixed once for all, and to open one and show its contents, or take some out and reclose the box is the work of a moment. This question is one of much greater importance than at first sight appears. Folding up and retying parcels is irksome and exceedingly uninteresting work, and is such as is not done very quickly at any time. Piles of packages which have been taken down to show customers, collect on the counters to be done up "presently," because they cannot be done up while the customer is being served.

These have to be done up, and some one must do it. Here is an important saving. One London ironmonger, whose sales in furnishing ironmongery, in a moderate sized shop, consist of about one half American articles, recently assured us that he had, from the saving of labor in this way, been able to dispense with about one fourth the assistance he would otherwise have required for the increased business done in small articles."

The Nevada Paint Mine.

The paint mine at Reno, Nevada, comprises a ledge 42 feet wide and of unknown depth. The material is said to mix well with oil, and not to settle on standing. The mineral contains a small quantity of silver and traces of gold.

American Flour in Turkey.

Mr. Heap, the United States Consul General at Constantinople, advises the Department of State that a demand for American flour will probably arise during the year in Turkey. As a large proportion of the flour imported will be for transportation on animals into the interior, he advises that it be put up in strong sacks. Most of the flour brought from Russia is in sacks or bags holding fifty or one hundred pounds each.

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Leadville—The Place.

This infant city of the past year, with its closely built streets, its bustle of trade, its throng of teams that fill and block the way, and its surging masses of humanity that move in ceaseless currents from daylight until the midnight hour, is one of the marvels of the age. The site is favorable—a smooth plateau, sloping gently to the west, rounding off into California gulch on the south, and rising to a slight ridge on the north. When the town began, the plat was covered with pine trees, but nearly all have fallen, and each day diminishes the few that ought to be carefully preserved. Fortunately, thick forests surround it on all sides, and most of the timber is green, furnishing excellent building material at the lowest possible cost. Building is going forward faster now than ever before, and the town spreads visibly day by day. Along all the roads leading out north and east, strings of foundations, half built or completed cabins, stretch continuously for a distance varying from half a mile to two miles. On the other sides they do not reach so far. There are hundreds, perhaps thousands, of these squatter claims, and it is nothing unusual to hear of their sale for $50, $100, or $200 each, when the improvement is nothing more than four logs, poles, or slabs.

The altitude is about 10,400 feet above the sea, and the outlook is grand and magnificent. To the east, beyond the swelling green of the fine forests, are the shining peaks of the Park range. Northward are lofty summits that close in the head of the valley of the Arkansas. Westward across the wide level valley, are those stupendous masses, Massive mountain, Mount Elbert, La Plata mountain, and all the magnificent Sawatch range, here the mother mountains. Southward the view is down the valley of the river—a vanishing vista, shut in by mountain walls.

The characteristics are those of any prosperous mining camp, but on a marvelous scale. There is an air of permanence not common to such, but otherwise the history of its growth has been a hundred times repeated in California, Nevada, and the Rocky Mountain States and Territories. Life is intensified. Everybody who has anything to do is on the jump. The rasp of the saw and tattoo of the hammer are heard from daylight to dark seven days in the week. Business occupies the same time and reaches far into the night as well. You must elbow and push your way through the crowds that fill the sidewalks, and wait for an opening in the teams and vehicles that throng the streets to cross from one side to another. Rents are fabulous. Real estate has advanced a thousand per cent in three or four months. Such is Leadville at a glance.—*Denver News.*

Spontaneous Combustion.

There was an interesting discussion on this subject at a recent meeting of the French Académie des Sciences. M. Cosson described an accident which had occurred in his laboratory a few days before. While the narrator was working in the laboratory, a portion of the boarding of the floor spontaneously took fire. The boards were in the vicinity of an air hole, fed with warm air from a stove four meters away on the floor below. A similar accident took place two years ago, and in consequence M. Cosson had the boards adjoining the air hole replaced by a slab of marble. The boards which now ignited adjoined the marble. The heat to which the boards were subjected was, however, very moderate, being only that of warm air at 25° C. Nevertheless, M. Cosson said the wood had undoubtedly been slowly carbonized. Being thus rendered extremely porous, a rapid absorption of the oxygen of the atmosphere had resulted, and sufficient caloric was thereupon produced to originate combustion. The danger thus disclosed, said M. Cosson, is one to which the attention of builders ought to be directed. In the instance in question, M. Cosson was able to extinguish the fire with a little water, as he was present and witnessed its beginning; but had it occurred at night, during his absence, it would undoubtedly have completed its work of destruction. M. Faye stated that at Passy, a few days before, a similar case of spontaneous fire, due to the action of the warmth from the air hole of a stove upon the wood work, had occurred at the house of one of his friends.—*Manchester (Eng.) Cotton.*

Mildew in Cotton Goods.

The different varieties of mildew that attack cotton goods belong to the fungoid class of plants—a division, perhaps, more numerous than any other section of the vegetable world. They propagate themselves by spores or seeds, which are generally diffused from bursting cells. These are carried—invisibly to the naked eye—upon every breeze in all directions, being deposited upon and in everything with which they come into contact. Few, probably, of the millions thus borne by the winds find fit habitats for development, and consequently perish in a short time. Too little is known of them to state with any degree of correctness the duration of the vitality of these germs. Doubtlessly it will be longer or shorter, accordingly as the circumstances in which they are deposited are favorable or otherwise. The plants, however, are purely parasites, finding their chief habitat upon organic substances, either vegetable or animal. And they are not particular whether these be living or dead—at least both living and dead organisms are subject to attack by the same or different species. They have cellular or filamentous bodies, and are concentric in their method of development. When full grown they are rarely uniform in shape. Contrary to nearly every other kind of vegetable life, they absorb oxygen and exhale carbonic acid. This causes the disagreeable odor always experienced in the presence of mildew. These parasites, in several of their numerous species, are found in cotton plantations, and in all probability the species peculiar to the plant is one of those with which merchants are too familiar. It is not unlikely that the spores, or seeds, are brought over in abundance with the raw cotton to this country, lying dormant until favoring circumstances stimulate their development. The germs are so minute that they can with ease run the gauntlet of all processes cotton undergoes in its transformation into cloth. It may be objected that these insignificant atoms of life could never preserve their vitality when passing along with cotton in the form of yarn through a trough of boiling size. This may safely be granted; but we do not size our wefts, and it is with the latter that it may be carried into a habitat fitted for its future growth. This view receives a considerable amount of confirmation from the fact that mildew most frequently takes place in goods in transit to India and China; otherwise expressed—when these germs are carried through latitudes identical with those of their native fields. Surrounded with every requisite condition—embedded in a mass of vegetable fiber, composed of interlaced threads the interstices of which contain a sufficient supply of oxygen in the atmosphere filling them; a large quantity of moisture, taken up by the natural, absorbent power of cotton from our humid atmosphere, or otherwise introduced; closely packed in an air-tight covering, and subjected for weeks to the stifling heat of a ship's hold in its passage through tropical oceans—sure, if there be a living germ of mildew in a ship's cargo of gray cloth, here are forces sufficient to render its development assured.—*Textile Manufacturer.*

What Came of one Hive of Bees.

In a memorial to Congress relative to the coming census of the United States, the superintendent of the census of 1860, Mr. Kennedy, gives the following statistics as an illustration of the stupendous results from a single hive of bees, transported to the Pacific coast less than thirty years ago. From the single county of San Diego, California, in 1876, there was shipped the astonishing figure of 1,250,000 lbs. In 1877 there were in that county 23,000 colonies of bees, and in one day, September 6, 1878, there were shipped from that port 78 barrels, 1,053 cases and 18 tons; and that from and including July 17 to November 10, 1878, less than four months, that one county exported over 1,000 barrels, 14,544 cases, and nearly 20 tons. He who would strike out (from the census report) the item of honey, could not have known, so great has the interest in this product become, that many people in California have from 500 to 1,000 hives, and that over 100 people in one county have each more than 100 colonies of bees. According to the London *News* of January 18, there arrived in November, at Liverpool, 80 tons of honey, the product of the bees of one individual; and that a Mr. Hodge, in the first week of January last, landed 100 tons at a London wharf, the product of California. The annual product of honey has grown to 35,000,000 lbs. annually.

Westward Progress of the Imported Cabbage Worm.

In 1869, in my second report, in treating of this insect, I remarked, "There is every reason to fear that it may some day get a foothold in our midst," after showing that it was then confined to certain restricted parts of Canada and New England, and had not spread west of New York. It has been making further progress westward every season since. The past year it has done considerable damage as far west as Chicago, and I have also received good testimony that it was observed around St. Louis. I have given my reasons in the report referred to for believing that it will prove much more disastrous to the cabbage fields around St. Louis than the southern cabbage worm (*Pieris protodice*), which has always been with us, and has done, at times, considerable damage; and I refer those who wish to be prepared with a full knowledge of the habits of this species, to the same report.

As remedies, few liquids will prove more effectual than hot water, judiciously applied, though 1 lb. of whale oil soap, dissolved in about 6 gallons of water, or even a strong tar water, may be used to advantage. The application should be made several times during the year, as it will be most effectual when the worms are young.

As preventive measures, the worms may be induced to transform under flat pieces of board laid upon any object that will raise them about an inch from the surface of the ground. These boards should be examined every week and the transforming larvæ or the chrysalids destroyed. The butterflies may also be captured by hand nets and prevented from laying their eggs.—*Professor C. V. Riley, before the Mo. State Horticultural Society.*

Borers in Apple Trees.

Now is a good time, says a writer in the *Rural Sun*, to cut out these pests where they have not been attended to.

A few days ago I went over an orchard that has fallen into my hands, and in one day's work think many valuable trees have been saved. As many as five full grown borers were cut out of one tree five inches in diameter. In some instances these were found running up the trunk six inches, and not over an inch apart parallel. It takes very close searching sometimes to find them. Sometimes a thin wire can be used with good effect, when the knife and chisel can hardly reach them. In quite a number of instances I found that the spotted woodpecker had done the work for me. They seem to know just where to find them when above ground, and rarely fail to bring them out. They need not peck a large place at all times, as their hard pointed, barbed tongue can be inserted and haul them out. It should be a rule among all to let these useful birds live undisturbed. They are tame, and boys are prone to stone them, or, when beginning to shoot, practice on these poor fellows.

When a tree is completely girdled by the borer or mice, it can often be saved by taking twigs of last year's growth, cutting wedge shape at both ends, and inserting in the bark below and above the injury, thus conveying the sap through them. Thus have we saved many a valuable tree that would otherwise not have survived the summer. After cutting out the borers fill up with earth over the wounds, and they will heal up if not too severe.

Flowers in Winter.

With but little trouble, says a correspondent of the *Country Gentleman*, any person can keep up a constant succession of beautiful flowers in the house from the holidays until the season of their blooming in the yard or garden. To do this, cut some small twigs of the various flowering shrubs or trees growing in the yard or lawn, and put them in bottles or jars containing pure water. If the weather is very cold when the twigs are cut, care must be taken not to injure the buds, which is very easily done when they are frozen. After the twigs are cut lay them in a cool room a few hours, then put them in the bottles of water, and let them remain two days in a cool place where the water will not freeze, after which they should be brought to the heat gradually. They will bloom if brought to the warmth when first cut, but the flowers and foliage are not so strong and luxuriant. After bringing them to the warmth the bottles should be filled up with fresh water every day.

When treated in this way, all the following named shrubs bloom nicely: *Daphne mezereum, Forsythia, Spiræa prunifolia, Deutzia gracilis, Lilac* (white and purple), *Pyrus japonica, Syringa, Wiegela,* and many others. The twigs of the *Cercis canadensis* (Judas tree, sometimes called Red Bud, which grows very abundantly in many places in our woodlands), when thus treated give a great profusion of beautiful red and purplish pink flowers, and are exceedingly beautiful.

I use hyacinth bottles, the tall ones of different colors. Beginning early in the winter with the Daphne and the Forsythia, they being among the first bloomers of spring, I tie a few twigs together with a soft woolen string (if tied tight it stops the flow of the sap), put them into the bottles, and give them plenty of light and water, and in two or three weeks have a nice bunch of flowers, the red contrasting beautifully with the yellow. In about a week after starting the first I set a couple more bottles, and so on until the fine fine warm weather of spring produces them out on the lawn. The Japan quince does not produce flowers on the small twigs of the last year's growth, but the buds are formed on the two year old wood; hence care must be exercised in selecting from this shrub, or no flower buds will be obtained. I now have Forsythia, Spiræa prunifolia, Lilac, Deutzia gracilis, and Daphne cneorum in full bloom, making a beautiful display in the window.

The Trade in Birds.

A busy but quiet industry in this city is that of the bird fanciers. A dealer in canary birds says that last year he imported 100,000 birds, which were readily disposed of at fair prices. They are generally brought from the Hartz mountain region of Germany. From the large dealers a fine male canary, with a good voice, can be bought for $3. Choice specimens, with extraordinary vocal powers, bring sometimes $10. Female birds for breeding purposes sell for $1. Next to the canary the mocking bird is most in demand. Those whose vocal powers are well developed are sold for $25 and upward. The birds come from Virginia and other Southern States, and also from Mexico. The bullfinch is highly regarded when well trained. A good whistler is worth from $25 to $40. The goldfinch, chaffinch, nightingale, lark, and the linnets and thrushes are also prized as songsters. Of other birds not songsters, thirty different species, kept as pets for their beauty or acquirements, may be found in market. Of these the parrot is most in demand. A well trained bird, of either the gray African variety or the green American, is worth $50, or even $100. The most brilliantly colored birds are the Australian paroquets and strawberry finches.

Sod Fences.

A Louisiana paper says that Mr. Joseph Jefferson has been fencing his orange grove plantation in that State in a novel and effective way. He begins by erecting, for each side of his fence, sods three feet in width, divided into five layers, at an angle of 75°. The soil from beneath the sod exactly fills the space between the erected sods, leaving a three foot ditch on each side. On the top of this sod-and-soil fence, which is four and a half feet at the base and three feet high, he plants cuttings of the Macartney rose, which are protected by a panel of boards. This fence, while within the reach of any man who will shoulder his spade and work, possesses the advantages of an impassable barrier, of permanence, of not needing repairs, of drainage, and of being a most beautiful ornament. Mr. Jefferson will soon have inclosed a section of his plantation containing 2,600 acres, and at one half the cost of a stake fence. It is thought that this most economical and useful fence will ultimately be generally adopted in the Southern States.

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The best results are obtained by the Imp. Eureka Turbine Wheel and Barber's Pat. Pulverizing Mills. Send for descriptive pamphlets to Barber & Son, Allentown, Pa.

The Railway Record, a journal of practical engineering and railway news, 28 pages, sent postpaid one year on receipt of price, $2. Address, The Railway Record, 37 Park Row, New York.

Valves and Hydrants, warranted to give perfect satisfaction. Chapman Valve Manuf. Co., Boston, Mass.

Kimball's Catarrh Cigarettes, an instantaneous relief and a pleasant smoke. They contain no tobacco.

Dead Pulleys that stop the running of loose pulleys and their belts, controlled from any point. Send for catalogue. Taper Sleeve Pulley Works, Erie, Pa.

Partner Wanted.—A suitable party with limited capital can open negotiations with a view to partnership, by addressing The Des Moines Linseed Oil Works, Des Moines, Iowa.

Renshaw's Ratchet (short spindle) uses taper and square shank drills. Pratt & Whitney Co., Hartford, Ct.

The Globe (Miner) Street Lamp; most durable; none better. Address J. G. Miner, Morrisania, N. Y. City.

"The best Article we ever had," is the (almost unanimous) verdict of those who fully test Downer's Improved Anti-Incrustation Liquid. It removes scale; it prevents its formation; is not injurious; does not cause the water to foam. A trial will establish the above claims. A. H. Downer, Proprietor, 17 Peck Slip.

Manfs. of Cracker Machinery and Ovens address F. S. & A. C. Wertz, Reading, Pa.

Wanted—Improved Stump Puller, with description and price. Address J. P. Rylander, Clarksdale, Miss.

S. C. Forsaith & Co., Manchester, N. H., and 213 Centre St., New York. Specialties—Bolt Forging Machines, Power Hammers, Combined Hand Fire Engines and Hose Carriages, new and 2d hand machinery. Send stamp for illustrated catalogues, stating just what you want.

For best, low priced Electric Bells, and other Electrical Apparatus, address Jerome Redding & Co., 30 Hanover St., Boston, Mass.

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The Asbestos Roofing is the only reliable substitute for tin, it costs only about one half as much, is fully as durable, and can be easily applied by any one. H. W. Johns Mfg. Company are the sole manufacturers.

Wanted—A Second-Hand Bolt Cutter, to cut from ⅜ or ½ inch up to 1¼ or 1½ inch, and tap nuts for same. Address P. O. Box 56, Hazleton, Pa.

Want to know if any one manufactures a Machine to twist Drills or Augers. Address P. O. Box 56, Hazelton, Pa.

Wanted—New or 2d hand Engine Lathe, 8 ft. x 18 in. swing. Address, with lowest cash price, H. H. Perkins, Kewanee, Ill.

Dead Stroke Power Hammers; cheapest and best for general forging and die marking. Philip S. Justice, Philadelphia, Pa.

Wanted—A Machine for Cutting a Hide into a Continuous Strip preparatory to running it through the tubes for sewing machine belts. Address Edmund Hill, 531 Jefferson St., Philadelphia, Pa.

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A Cupola works best with forced blast from a Baker Blower. Wilbraham Bros., 2,318 Frankford Ave., Phila.

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Special Notice.—Send for Electroplater's Catalogue and Price List to Partrick & Carter, Philadelphia, Pa.

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Wood-working Machinery, Waymouth Lathes. Specialty, Wardwell Patent Saw Bench; it has no equal. Improved Patent Planers; Elevators; Dowel Machines. Rollstone Machine Company, Fitchburg, Mass.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) G. R. P. asks: What is the best manual for field assaying and mineralogical handbook for one with some theoretical knowledge of the subject? A. Consult the works of Professor Blossom and P. de P. Ricketts, School of Mines, Columbia College, New York.

(2) R. A. F. asks what the size of the ports leading from the steam chest to the cylinder of an engine should be, 2½ inch bore, 4 inch stroke. A. ⅛ inch by ¾ inch long.

(3) S. A. B. asks: Is there anything that prevents hard water from foaming in the boiler? A. Introducing a small quantity of oil or petroleum has a temporary beneficial effect.

(4) C. H. & G. W. H. ask for the rule for calculating the horse power of an engine. A. Multiply the area of the piston by the average pressure per square inch, and that product by the speed of the piston in feet per minute, and divide by 33,000; quotient is the horse power.

(5) F. C. S. asks: 1. What kind of rubber is used for rubber stamps, and how is it prepared to receive the impression? A. Purified gum rubber (caoutchouc) is softened by gentle heat, and while in that condition about 5 per cent of sulphur is thoroughly incorporated with it by a kneading process. 2. Will the rubber used by dentists answer the purpose? A. No; it usually contains an excess of sulphur.

(6) "Subscriber" writes: Sunday night, March 16, a hard rain fell in this section of country. The next day and for several days after there could be seen a yellow substance very much resembling pulverized sulphur. A few pronounced it eggs. Your opinion is desired. A. It is the pollen of the white pine (*pinus strobus*).

(7) B. asks if there are any compressed air engines manufactured in the United States, and if so where and by whom? A. If you mean engines driven by compressed air, there have been some built by way of experiment; we know of no party who makes a business of building them.

(8) W. K. H. writes: We have a 10x24 engine, driving wheel 9¼ feet, saw pulley 1¼ feet, diameter of saw 56 inches, 15 teeth with 1⅛ inch feed; with 80 lbs. steam ought we to have power to use same saw with 30 teeth and 2¼ inches feed in cypress timber; or is there too much leverage against the engine? A. If your cutting instrument (the saw) cuts with equal effect in both cases, the power required will be nearly double with 2¼ inch feed, that for 1⅛ inch feed.

(9) C. B. asks: How may I separate nitrate of silver from nitrate of copper so that I may procure the nitrate of silver? A. Add excess of muriatic acid to the warm solution, gather the precipitate on a filter, wash it with fresh water, dry, mix with a little powdered borax and rosin, and heat strongly to fusion in a small crucible; cool, break the crucible, hammer the button of silver, dissolve it in warm nitric acid, evaporate the solution nearly to dryness in a porcelain dish, and dissolve the residue (nitrate of silver) in distilled or rain water.

(10) F. W. B. writes: Engine 27 on this road has a diameter of piston of 14 inches and exhaust 2½ inches. Engine 76 has a diameter of piston of 16 inches and exhaust 3 inches. Which engine has the greatest area of exhaust in comparison with its area of piston surface? A. The 16-inch cylinder with 3 inch exhaust; the difference is very small.

(11) F. C. R. asks: 1. What is the horse power of an engine, the cylinder of which measures 3x1¾ inches, thickness of piston ½ inch? A. Power would depend upon pressure of steam and number of revolutions per minute. 2. Would such an engine have power enough to propel a small boat, say 16 feet long and 3 wide, weighing about 80 lbs.? A. No.

(12) C. F. F. wants to know (1) if ordinary river water will do as well for reducing alcohol for vinegar as rain water? A. If the water is suitable for drinking purposes, yes; otherwise no. 2. Is water from the ice of a river better for this purpose than water taken from the same river? A. Ordinarily, yes. 3. Also about what amount of rain falls per annum upon a foot of surface in this state (Iowa). A. Consult the meteorological reports of your State; we have not the statistics at hand.

(13) R. & T.—It consists chiefly of lime carbonate, iron oxide, alumina, silica, and organic matter. Use a feed water heater, and blow off frequently.

(14) D. K. E. F. asks (1) whether a small screw propeller steam engine could be put into an ordinary row boat of 16x3¼ feet without much difficulty or cost. A. About 3 horse power nominal. 2. Also about what the engine would cost and how many miles per hour it would run a boat of this size? A. Cost about $550; speed 5 to 6 miles per hour.

(15) R. G. asks (1) for a simple rule for finding the gear wheels for cutting different threads on the usual compound gear lathes. A. $\frac{T}{t}\frac{S}{t'} I = N$; $\frac{t}{I}\frac{t'}{T} = S$. T represents the number of teeth in wheel on traverse screw; S, number in stud wheel gearing in mandrel; t, number in wheel upon mandrel, and t', number in gearing upon stud pinion, gearing in T; I, number of threads per inch upon traverse screw; N, number to be cut. 2. What is the horse power of an engine, the cylinder being 10½ inches diameter, stroke 24 inches, number of revolutions per minute 63, mean pressure 60 lbs.? Also the same cylinder and stroke, with 66 revolutions and 85 lbs. pressure? A. See reply to C. H. on this page.

(16) F. R. asks how to find the horse power a belt will pull, when the width and speed are known. A. A simple and safe rule is, 1 inch width of belt running 600 feet per minute equals 1 horse power, hence multiply the width in inches by speed in feet per minute and divide by 600—result is the horse power.

(17) H. H. C. asks for the rule for finding the tonnage of a flat bottom boat. A. For carpenter's tonnage multiply together length, breadth, and depth in feet, and divide by 95.

(18) D. K. asks: What will make a good article for quickly removing the black coating from human teeth? A. The black coating is tartar, a concretion consisting of salivary mucus, animal matter, and lime phosphate. The best method is to have it removed by a dentist. The use of acids for this purpose is injurious, since the enamel is also affected.

(19) O. B. asks: Is there often or ever any commotion of the water in a steam boiler while carrying an ordinary working steam pressure? A. Always after ebullition commences.

(20) J. S. writes: I have a No. 2 Blake pump; I had occasion to take off the steam chest, and pump by hand, but pump would not throw until I covered the ports air tight. I would like to know why pump will not throw until ports are covered. A. The pump took in air through openings. 2. I am using sulphur and copperas water. What would be a good preparation to use, to save my boiler? A. The introduction of a small quantity of soda (dissolved) or lime water would be beneficial.

(21) E. E. C. asks: Does common sulphuric nitric or other mineral acids attack white rubber tubing and stopples? A. If concentrated, yes.

(22) "Worker" writes: I wish to fasten cloth or leather on an iron wheel (the iron is planed, not polished); the wheel runs 5,000 turns per minute. I cannot use a wooden wheel for the work. A. If possible lap the strip several times around, roughen the periphery of the wheel, warm it, and fasten the strip with a melted mixture of equal parts gutta percha and black pitch. Allow the cement to thoroughly harden before using the wheel. If the strip is not tightly lapped it will be difficult under the circumstances to hold it firmly in position.

(23) B. asks: 1. Is there any oil cheaper than alcohol to run toy engines that gives as little smoke? A. No. 2. What power and what will be the cost of engine, boiler, and hand pump to run a row boat that will carry 3 or 4 persons at say 6 or 7 miles per hour? A. About 3 horse power; cost about $550.

(24) E. P. writes: I have a quantity of bones, about 10 bushels, which I would like to reduce to a state suitable for fertilizing. What shall I use to dissolve them? A. Ground bone or "bone dust" is extensively used for fertilizing purposes. The ground bone may be converted into so-called ammoniated superphosphate by mixing it thoroughly with about 40 per cent of common sulphuric (oil of vitriol), somewhat diluted with water, and permitting the mixture to stand for a week or more that the reaction may be complete. Warm hydrochloric acid will dissolve the bones, but this is not used, as a solution is not required.

(25) J. A. F. writes: I am putting up a steam engine and boiler, and in putting in the pipe for the water-glass and gauge cocks, I wished to have the pipe that came from the steam dome larger than the one that came from the water in the boiler. The proprietor held that they should be the same size. Who is right? A. It makes no difference whether of same size or not; but they should be large enough to keep free at all times. 2. He holds that if a gauge were placed in the bottom of the boiler and one in the dome, they would both show the same pressure; I say that the one in the bottom of the boiler would show the weight of the water the most. Am I right or wrong? A. You are right.

(26) M. A. B. writes: While riding on a locomotive, several days ago, I noticed small flakes pass up and down in the glass water gauge. On asking the engineer about this he said that they were small pieces of glass that kept peeling off. This, he said, goes on until the glass gets quite thin, when it finally breaks. Is there something in the glass or water, or is this always the case? A. Water gauge tubes usually decay or wear away at the ends in the stuffing boxes; we have never seen or heard of such flaking off as you describe. If any of our subscribers have noticed such action upon tubes, we shall be glad to hear from them.

(27) J. A. C. writes: I have read your article on Peter Cooper's life with great interest. I wish you could extend it. But to my mind it suggests a question not directly mentioned by you; the loss of time and effort in learning three trades and the doubts and difficulty in learning any. Can you show how a boy may know whether to learn a trade or not, and how he may know what trade to learn? A. The boy had better learn the trade he fancies; or, if he has no preference, the trade which he can undertake under the most favorable conditions. Whatever his ultimate occupation may be, the learning of any trade in youth will be an advantage to him; by trade we mean of course some form of manual labor whereby a man may earn an honest living. The greater the intelligence and skill involved in its mastery, the better, if the boy has the physical and mental capacity for it. In every case boys should be encouraged to learn a trade, as a necessary part of a man's education.

(28) M. M. W. writes: Please answer through the columns of your paper the following question: Which has the easier draught, a wagon with a small wheel or one with a large wheel? A. The latter.

(29) F. J. R. asks (1) how to make a calculation on a safety valve, so that I may set it, and tell how much steam I have in case I have not a steam gauge. A. Multiply weight in lbs. by its distance in inches from fulcrum, divide the product by the distance in inches from the fulcrum to the bearing point on the valve, divide this quotient by the area of the valve in square inches, the result is pressure per square inch; this does not take into consideration the effective weight of the lever and the valve, but the error is small and may be neglected. 2. Will you also recommend me some good books, that will explain machinery, and where I can buy them? A. Haswell's Pocket Book will be useful for you. It can be purchased from dealers who advertise in our columns.

(30) G. A. H. asks: Which will create the better draught, a seven inch pipe over a six inch flue or a six inch pipe over the same flue? A. Difference ordinarily in favor of the 7 inch pipe.

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(31) P. J. writes: 1. At this place large quantities of sawdust, chips, and similar refuse from planing mills are being deposited in the shallow water at the shore here. What is going to become of this in time, and what are the sanitary effects of the material while the changes are going on? A. It depends much upon the nature of the soil or drift—if undisturbed it may ultimately pass into a variety of brown coal or lignite. Under the circumstances we think the slow process of change will not very materially affect the health of near residents. 2. Are any injurious effects to health likely to arise from accumulations of sawdust, shavings, etc., in a back yard exposed to the weather? A. Probably not, to any extent. It would, however, be advisable to remove it occasionally.

(32) J. A. L. asks: How are the marks of a boxwood rule put on, and how are they colored black? A. They are regularly printed from a steel die, which indents the wood and leaves the ink.

(33) J. D. C. asks for a rule for calculating the power of a double toggle joint press, the toggles being operated by a right and left hand screw passing through nuts in the middle joint of the toggle. A. By the principle of virtual velocities: the power applied to the handle of the wheel on the screw, multiplied by the travel of the handle in a (small) unit of time, the product divided by the movement of the platens in the same time; the result, less the friction of the machine, will give the pressure on platens in that particular position, but the power is constantly changing with the change in the angle of the links. This rule is not strictly accurate, but will answer practical purposes.

(34) "Squirrel" writes: A hunter discovers a squirrel upon the trunk of a tree. As he follows it around the tree the squirrel keeps on the opposite side of the tree. The hunter is supposed to go a greater distance in circling the tree than the squirrel. Does or does he not go around the squirrel in making a circle of the tree? A. He goes round the squirrel. (1) He goes round everything within the circle of his course, whether the included objects are at rest or in motion. It makes no difference whether the squirrel keeps the tree between himself and the hunter all the time, or part of the time, or none of the time, the hunter goes round him. 2. It is admitted that the hunter goes round the tree. If he does not also go round the squirrel on the tree, he must, at some stage of the journey, go between the squirrel and the tree, which is contrary to the conditions of the case.

(35) F. asks: 1. What instruments are used in making perspective drawings? A. The camera obscura, the camera lucida, and the perspective linead. 2. And what is the best instrument for describing an ellipse? A. The trammel and the ellipsograph.

(36) W. S. G. asks if there is any cheap means of deodorizing carbon or ground oil. A. It cannot be completely deodorized, but the unpleasant odor may be nearly destroyed. Violently agitate it for some time with about three per cent of sulphuric acid, and after settling draw off from the scum and impurities; agitate for half an hour or more with clean water containing a few per cent of chloride of lime (calcium hypochlorite), settle, draw off, and agitate with weak aqueous carbonate of soda solution. Finally, agitate with powdered quicklime, and let it stand until it becomes perfectly clear.

(37) J. F. writes: A friend of mine says that the driving wheels of a locomotive should be made as light as possible, and that the best place to put the weight is in the boiler and frames. I say that the best place to put the weight is in the wheels, for then there is less required on the journals. Who is right? A. Your friend is right; weight placed below the springs is much more injurious to the rails than the same weight above the springs, hence, the wheels, axles, boxes, and eccentrics should be as light as consistent with their work.

(38) W. F. C. asks: 1. How long will a U magnet retain its power? A. If provided with an armature and not jarred or suddenly separated from its armature it will retain its magnetism indefinitely. 2. Where can I get a good magnet? I don't see anything of the kind advertised in your columns. A. Dealers in philosophical instruments keep them, and they may usually be purchased from dealers in general hardware. 3. What metal is most easily attracted by the magnet, or on what substance has the magnet the most power to attract or repel? A. Another magnet. 4. How can I make a powerful electro-magnet? A. By bending a bar of round iron into a U form and placing on each limb a bobbin of insulated copper wire. The power of a magnet depends on its size, upon the size of the battery in connection with which it is used, also upon the size of the wire used and the number of convolutions of the bobbins.

(39) R. C. writes: In a recent number of your valuable paper, I read a notice about observations made in England for ozone. Could you tell me where any regular observations are made in this country, and what method they use? A. Few systematic observations upon atmospheric ozone have been prosecuted, or, if carried on, have rarely been published. You will find an exhaustive article on this subject in No. 154 of the SCIENTIFIC AMERICAN SUPPLEMENT.

(40) H. S. H. asks: 1. What is Ohm's "law," or where can I find it? A. Ohm's law is as follows: The strength of the current is equal to the electro motive force divided by the resistance. You will find Ohm's law in almost any work on physics. 2. Which of the following batteries will do the most work at the least expense: Daniell, Grove, Carbon, or Leclanche? A. It depends much on the kind of work required. For open circuits the Leclanche is best; for closed circuits the Daniell is best. 3. Will it in any way affect the working of any of the above, to close them up water tight? A. Most batteries generate gas, which must have an escape. 4. Will the Leclanche battery be affected by any motion (say that of a small boat) that will cause the disturbance of the liquid inclosed? A. We do not think that motion would seriously affect the working of the Leclanche battery.

(41) H., I. & Co. ask: When running a high pressure engine on 80 lbs. steam and exhausting into an improved condenser, condensing with cold water at 60° temperature Fah., how many times the volume of condensed steam will be required in cold water at 60° in order to procure 1 lb. vacuum? Also how much to procure 10 lbs. vacuum? A. Compute the temperature of the water of condensation by rule in Haswell's Pocket Book, page 577; from this temperature ascertain from a table of temperatures the back pressure, and deduct this from 14·7 lbs., the result will be the amount of vacuum obtained. Note that your 80 lbs. pressure is above the atmosphere, and its temperature is 323° Fah.; the temperature due to 1 lb. vacuum is 207°, and that due to 10 lbs. vacuum 160° Fah.

(42) B. M. A. asks if there is a flux that will make tinsmith's solder flow as freely on cast iron as it does on tin. A. A good flux for this purpose is made by putting zinc into muriatic acid until bubbling ceases.

(43) D. B. L. asks how the precious metals are separated from each other and from the base metals where carried on on a large scale. A. Consult "Elements of Metallurgy," by J. A. Phillips, London, 1874.

(44) W. H. C. writes: I contemplate making a lightning rod by riveting strips of sheet copper together and nailing the same to my house, using proper points. Is there any danger of shingle being set fire by lightning passing down the same, or other objection to a rod constructed on the above plan? A. If the copper strip were of liberal size and the ground connections good it would be efficient.

(45) R. E. H. asks: 1. Will a steel spring give back as much force in the recoil as was spent in compressing it, and if not what is the waste? A. Yes, if not strained so as to effect a "set." 2. Will air if compressed and then allowed to expand give back as much force in the expansion as it received in the compression? A. Yes.

(46) W. S. writes: 1. We use plaster of Paris moulds for pottery and earthenware. What can be added to the plaster to improve it, as it soon pits and chips? A. Try a hot solution of alum and water glass. 2. What work will give me the most information on the different metals and clays used in the industrial arts as to their fusing points, manufacture, and cost? What is the best work on the analysis of clays, soils, etc.? A. You may consult Wagner's "Chemical Technology," Cook's report on New Jersey clays, and Caldwell's "Agricultural Analysis."

(47) C. B. F. asks: 1. What is the best and cheapest water motor for running a sewing machine on a low water pressure? A. Consult our advertising columns. 2. What will take linseed oil and putty stains out of a marble washstand? The above materials were used to cement water basin to the marble slab. A. Mix up a quantity of the strongest soap lees with quicklime, to the consistence of milk, and lay it on the stone for twenty-four hours; clean it afterwards by using fine putty powder and water.

(48) J. M. H. asks: In a well eighty feet deep where should the cylinder be placed, at the top or at the bottom—depth of water 20 feet? A. Place the pump not more than 20 to 25 feet above surface of water.

(49) W. B. C. asks whether a liquid tight packing for piston has ever been discovered. If there has been such a packing used, what is it? A. The best liquid tight packing, is a cap packing of either leather or India rubber.

(50) M. F. L. asks at what point the exhaust should enter a tank, whether above or below the water line, and is it necessary that the egress opening should be larger than the ingress to the tank. A. If the exhaust is merely blown into the tank, above the water, the egress may be somewhat the smallest if you wish to use the water quite hot.

(51) P. F. S. writes: A is running an engine 14 inches diameter, and 24 inches stroke, with exhaust 2¼ inches diameter. B is running an engine 16 inches diameter, and 24 inches stroke, with 3 inch diameter exhaust pipe. A contends that his exhaust is larger in proportion to his cylinder than B's. B contends that his exhaust is larger than A's, in proportion to the cylinder. Which is right? A. The proportion of exhaust in B's engine is the largest.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

C. M. M.—It consists chiefly of quartz and orthoclase and talcose schist, with a small quantity of ferruginous matters. The rock probably contains a trace of silver. —"Exeter."—It is mispickel or arsenical pyrites—arsenic 46·0, sulphur 19·6, iron 34·4.—H. S.—The water contains much aluminum and iron sulphates. The styptic taste is due chiefly to the latter salt. It is not fit to drink. The brown precipitate is iron oxide.—J. M.—The orthoclase rock contains micaceous or specular hematite (iron sesquioxide) and ilmenite—titaniferous iron.—G. T. B.—We think your specimen is not meteoric iron.—W. C.—It is graphic granite. Besides graphite (plumbago or blacklead) it contains much iron sulphide—pyrites—and hornblende.—G. L. R.—The vermilion contains much oxide of mercury, which probably reacts upon the oils used and upon the sulphide of mercury, forming a basic sulphate.

COMMUNICATIONS RECEIVED.

On a New Use for Petroleum. By J. S. M.
On the Siphon. By J. E. H.

English Patents Issued to Americans.

From March 18 to March 21, inclusive.

Axles, H. Watkeys, Syracuse, N. Y.
Candlestick, A. J. Smith *et al.*, Ukiah City, Cal.
Clutch mechanism, T. W. Capen, Stamford, Conn.
Engine, hot air, H. W. Sherrill, Jersey City, N. J.
Gas checks for ordnance, B. B. Hotchkiss, ——, N. Y.
Millstone driver, P. H. Childress, Waynesboro', Va.
Pumping machinery, E. J. Molera, San Francisco, Cal.
Railway switch, J. S. Riverton, ——, N. J.
Screws, C. C. Dayten, Plymouth, Mass.
Sewing machines, G. McKay, Boston, Mass.

[OFFICIAL.]

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FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

March 18, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city.

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Ammoniacal gas, dry, F. M. McMillan 213,294
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[COPY.]

OLNEY, ILL., March 19, 1879.

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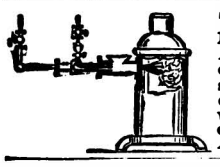
JOHN KNOWLES, Under Secretary for Public Works.



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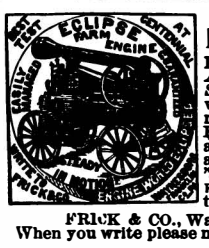

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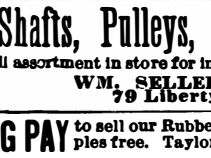

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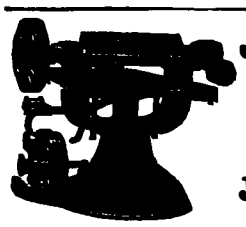

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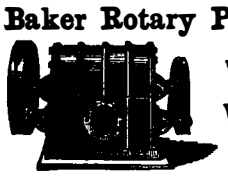

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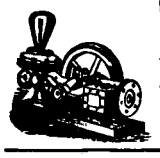

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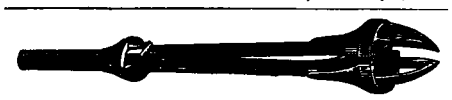

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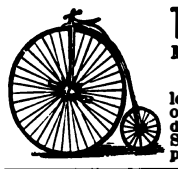

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